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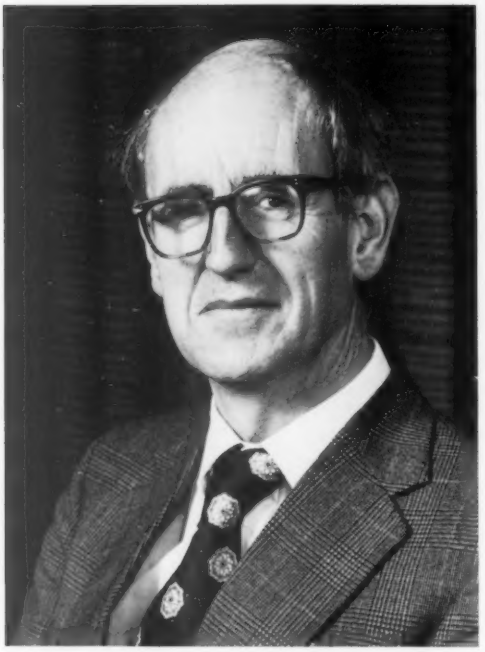
No. 1318, May 1982, Vol. 111



Dr K. H. Stewart

Retirement of Dr K. H. Stewart

When Dr K. H. Stewart retired as Director of Research on 29 March 1982 the Meteorological Office lost one of its most able scientists of the post-war generation and one who had contributed greatly to its research in physical meteorology for more than 30 years.

Educated at Ottershaw College, Chertsey, and Trinity College, Cambridge, Ken Stewart graduated in 1943, received his MA in 1946, and obtained a PhD in 1949 for research on the behaviour of ferro-magnetic materials. Indeed he wrote a monograph on Ferro-magnetic Domains while still a research student. This was published by Cambridge University Press in 1951 and was very well received.

After leaving the Cavendish Laboratory he joined the Meteorological Office in 1949 and, after a period of forecasting training, was posted to Victory House to study problems of horizontal and slant visibility under Dr A. C. Best. In 1954 he went to Kew Observatory as a research scientist under Dr G. D. Robinson. During the next seven years or so he carried out a series of investigations on visibility and on the constitution, formation and dissipation of radiation fog. These included a notable design study, followed by some experimental trials, on the feasibility of dissipating fog by spraying it with hygroscopic particles.

It was during this period that, despite his quiet and retiring nature, his abilities as an experimental physicist came to the fore and were clearly recognized by his seniors. He was promoted to Principal Scientific Officer in 1957, at the then very early age of 35, and remained at Kew until he joined the newly-formed High Atmosphere branch at Bracknell in 1961. It was here, during the next 13 years, that he was to do his most important scientific work for which he received the L. G. Groves Memorial Prize in 1964 and achieved promotion to Senior Principal Scientific Officer (Special Merit) in 1965. Stewart's group was the first in the Office to develop highly sophisticated instruments for both rockets and satellites and to introduce the advanced techniques necessary to build these in house. He was personally concerned with measurements of the concentrations of ozone and molecular oxygen in the stratosphere from both the Ariel II and III satellites and measurements of solar ultra-violet radiation and ozone with Skylark rockets fired from Woomera. He also contributed to the design of the Meteorological Office version of the pressure-modulated radiometer that is at present obtaining excellent measurements of stratospheric temperature on board the US Tiros-N series of satellites.

Although up to this stage of his career Ken Stewart had been regarded as a back-room research scientist, it became evident that he had the leadership qualities required of a successful manager and so, in 1974, he was promoted to the post of Deputy Director (Physical Research) and then, in 1976, he followed Mr J. S. Sawyer as Director of Research with the rank of Under Secretary. In these roles Dr Stewart has played a very important and influential role in guiding a large and broad research program. A man of few words, his authority derives from a first-class scientific mind, excellent judgement and the ability to spot any weakness in a scientific argument. He has also played a very important role in the development of the European geostationary satellite (Meteosat) especially as Chairman of the Scientific and Technical Advisory Group where his efforts have been greatly appreciated, not least by his European colleagues.

I shall miss his wise and courteous counsel and I am sure that all his colleagues would wish to join with me in wishing Ken and Hilary Stewart a long, fruitful and happy retirement.

B. J. MASON

551.5(09): 551.509.21:06

The Daily Weather Report and associated publications: 1860–1980

By R.P.W. Lewis
(Meteorological Office, Bracknell)

Summary
A brief historical account is given of the *Daily Weather Report*, *Daily Aerological Record*, and *Overseas Supplement* to the *Daily Weather Report* published by the Meteorological Office between 1860 and 1980.
Photographs of typical examples are included.

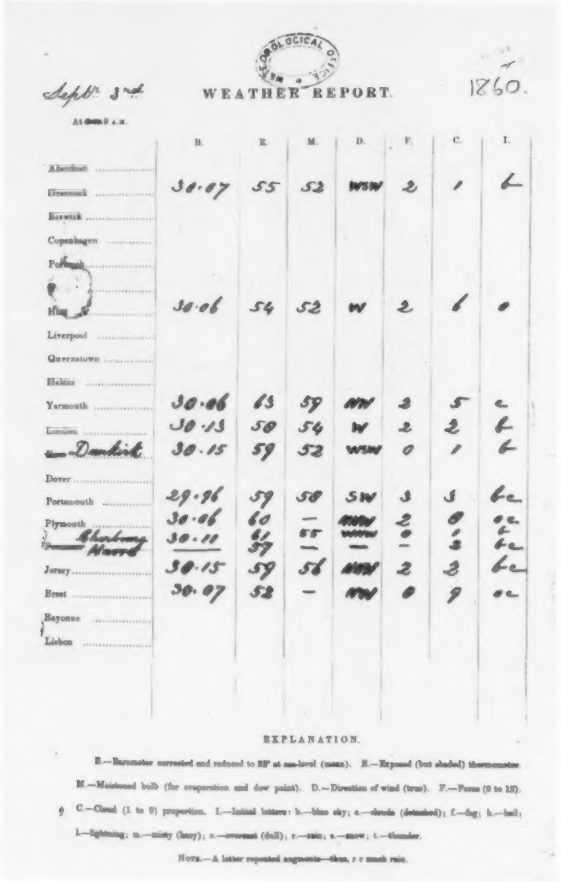
With the demise of the *Daily Weather Report* and the *Daily Aerological Record* at the end of 1980, more than 120 years of daily publication of British weather data by the Meteorological Office came to an end. This article sketches the history of these publications and a selection of them are shown in the illustrations.

The first *Daily Weather Report (DWR)* of the Meteorological Office was issued free to the Press on 3 September 1860 and consisted of a brief tabulation of data handwritten on a printed form. Gradually, the tabulations became fuller and more elaborate, and remarks and a weather outlook were added, but duplicate copies continued to be handwritten until July 1868 when copying by lithography was introduced. In 1871 the Meteorological Committee were shown copies of daily charts produced in the United States, and decided that daily charts should be produced by the Office too; the first *Report* containing charts appeared on 11 March 1872. These more elaborate *Reports* were, like the earlier ones, reproduced by lithography and about 200 copies were run off, some of which were sold to the public. The minutes of the Meteorological Committee record negotiations with the Revd C. H. Griffith who declined to take out an annual subscription for £5 (including postage) but agreed when the Office brought the price down to £2.10s.* Forecasts were first included in the *Report* on 1 January 1881.

When the Office moved from Westminster to South Kensington in 1910, it was discovered that the new site was too far from lithographic printing establishments for speedy reproduction of the *Report* to be carried out under the old arrangements, and it was therefore decided to set up a press actually within the Office; this press started work on 1 January 1911 and was run by Wyman and Sons under contract from His Majesty's Stationery Office (HMSO).

In 1919, after the First World War, the Meteorological Office expanded considerably and was placed administratively under the Air Ministry, largely because of the greatly increased amount of work on the new task of forecasting for aviation; the Forecasting Office was in consequence transferred to an Air Ministry building in Kingsway. From January 1920 the *Reports* were printed at the Kingsway building on a press run directly by HMSO, an arrangement which was to continue during the period at Dunstable (from 1940 to 1961) and then at Bracknell.

*For comparison, the annual subscription in 1980 (1st class post) was £86.55.



Sept. 3rd

WEATHER REPORT.

1860.

At 9 A.M.

	B.	E.	M.	D.	F.	C.	I.
Aberdeen							
Greenock	30·07	55	52	WSW	2	1	b
Berwick							
Copenhagen							
Portsmouth							
Hull	30·06	54	52	W	2	6	o
Liverpool							
Queenstown							
Hebides							
Yarmouth	30·06	63	57	NW	3	5	c
London	30·13	58	54	W	2	2	b
Dunbar	30·15	59	52	WSW	0	1	b
Dover							
Portsmouth	29·96	59	58	SW	3	3	bc
Plymouth	30·06	60	—	NW	2	0	oc
Glenburg Head	30·10	61	55	WSW	0	1	c
		57	—	—	—	3	bc
Jersey	30·15	59	56	NW	2	3	bc
Brest	30·07	52	—	NW	0	9	oc
Bayonne							
Lisbon							

EXPLANATION.

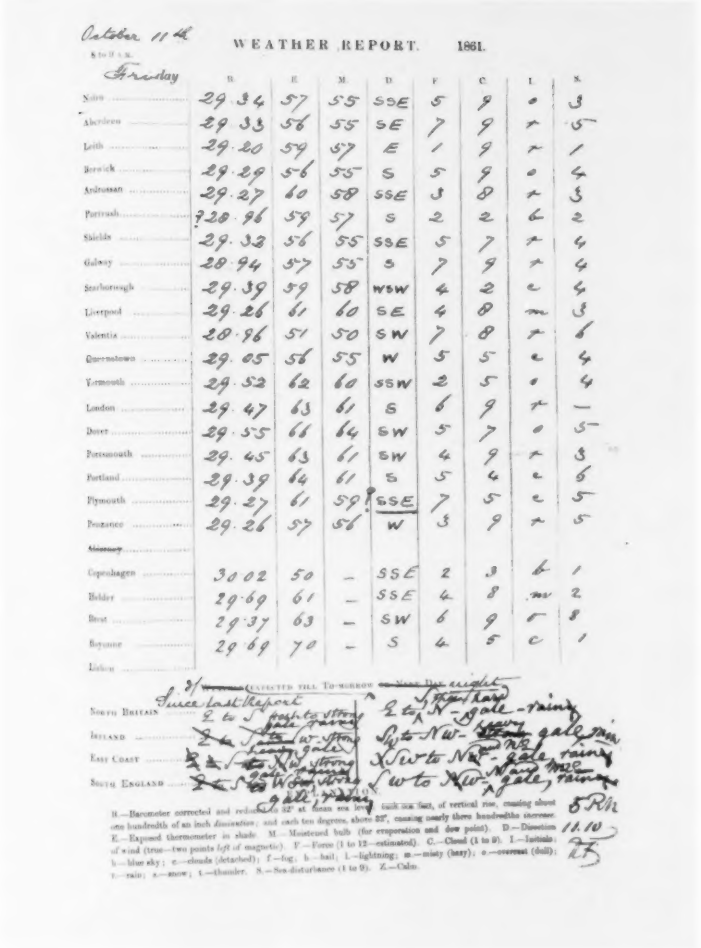
B.—Barometer corrected and reduced to 32° at sea-level (mean). E.—Exposed (but shaded) thermometer.

M.—Moistened bulb (for evaporation and dew point). D.—Direction of wind (true). F.—Force (0 to 12).

C.—Cloud (1 to 9) proportion. I.—Initial letters: b.—blue sky; c.—clouds (detached); f.—fog; h.—hail; l.—lightning; m.—misty (hazy); o.—overcast (dull); r.—rain; s.—snow; t.—thunder.

NOTE.—A letter repeated augments—thus, r r much rain.

Figure 1. First *Daily Weather Report (DWR)*, issued to the Press on 3 September 1860.



October 11th

WEATHER REPORT. 1861.

8 to 9 A.M.

Friday

	B.	E.	M.	D.	F.	C.	I.	N.
Nairn	29.34	57	55	SSE	5	9	o	3
Aberdeen	29.33	56	55	SE	7	9	r	5
Leith	29.20	59	57	E	1	9	r	1
Berwick	29.29	56	55	S	5	9	o	4
Ardrossan	29.27	60	58	SSE	3	8	r	3
Portrush	?29.96	59	57	S	2	2	b	2
Shields	29.32	56	55	SSE	5	7	r	4
Galway	29.94	57	55	S	7	9	r	4
Scarborough	29.39	59	58	WSW	4	2	c	4
Liverpool	29.26	61	60	SE	4	8	m	3
Valentia	29.96	51	50	SW	7	8	r	6
Queenstown	29.05	56	55	W	5	5	c	4
Yarmouth	29.52	62	60	SSW	2	5	o	4
London	29.47	63	61	S	6	9	r	—
Dover	29.55	66	64	SW	5	7	o	5
Portsmouth	29.45	63	61	SW	4	9	r	3
Portland	29.39	64	61	S	5	4	c	6
Plymouth	29.27	61	59	SSE	7	5	c	5
Penzance	29.26	57	56	W	3	9	r	5
Alderney								
Copenhagen	30.02	50	—	SSE	2	3	b	1
Helder	29.69	61	—	SSE	4	8	mr	2
Brest	29.37	63	—	SW	6	9	r	8
Bayonne	29.69	70	—	S	4	5	c	1
Lisbon								

Since last Report

North Britain

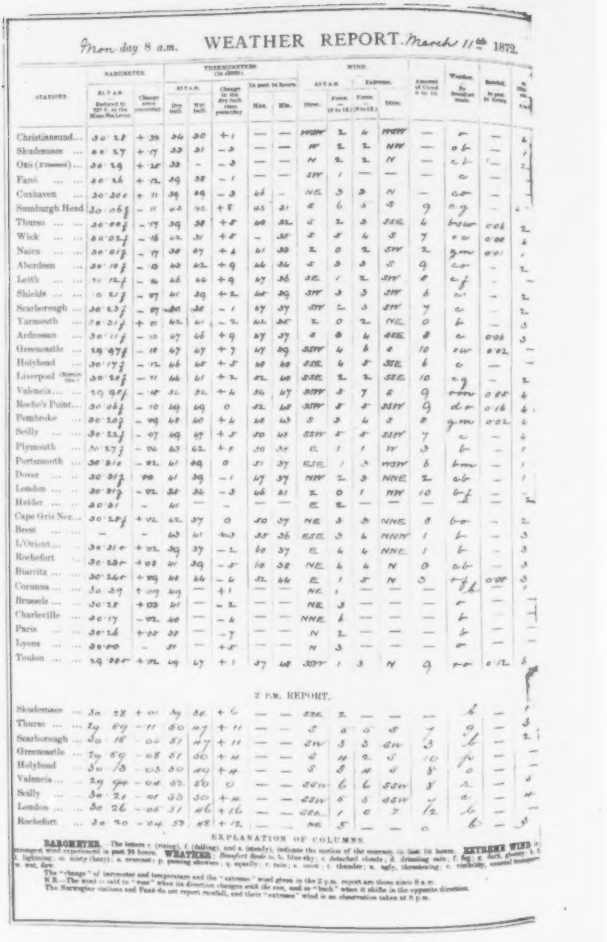
Ireland

East Coast

South England

B.—Barometer corrected and reduced to 32° at mean sea level (unit one foot, of vertical rise, causing about one hundredth of an inch *diminution*; and each ten degrees, above 32°, causing nearly three hundredths increase. E.—Exposed thermometer in shade. M.—Moistened bulb (for evaporation and dew point). D.—Direction of wind (true—two points left of magnetic). F.—Force (1 to 12—estimated). C.—Cloud (1 to 9). I.—Initials: b—blue sky; c—clouds (detached); f—fog; h—hail; l.—lightning; m.—misty (hazy); o.—overcast (dull); r—rain; s.—snow; t.—thunder. N.—Sea disturbance (1 to 9). Z.—Calm.

Figure 2. Early *DWR* initialled by Admiral FitzRoy (bottom right).



Monday 8 a.m. WEATHER REPORT. March 11th 1872.

STATIONS	BAROMETER At 9 A.M. Reduced to 32° F. at the Mean Sea Level	BAROMETER Change since yesterday	THERMOMETERS (In shade.) At 9 A.M. Dry bull.	THERMOMETERS (In shade.) At 9 A.M. Wet bull.	THERMOMETERS (In shade.) Change in the dry bulb since yesterday	THERMOMETERS (In shade.) In past 24 hours. Max.	THERMOMETERS (In shade.) In past 24 hours. Min.	WIND At 9 A.M. Direc.	WIND At 9 A.M. Force (0 to 12.)	WIND Extreme. Force (0 to 12.)	WIND Extreme. Direc.	Amount of Cloud 0 to 10.	Weather. In Breakfast room.	Rainfall. In past 24 hours.	Sunshine. In past 24 hours.
Christiansund	30·28	+·39	36	30	+1	—	—	WSW	2	4	WSW	—	c	—	4
Skudenæs	30·27	+·17	39	31	−3	—	—	W	2	2	NW	—	b c	—	1
Otis (Fahrenheit)	30·29	+·26	33	—	−3	—	—	N	2	2	N	—	c b	—	2
Fanø	30·36	+·12	39	38	−1	—	—	SW	1	—	—	—	c	—	
Cuxhaven	30·301	+·11	39	29	−3	46	—	NE	3	3	N	—	c o	—	
Sumburgh Head	30·06	−·11	42	42	+8	45	31	E	6	8	S	9	c g	—	4
Thurso	30·08	−·17	39	38	+5	40	32	S	2	3	SSE	4	h r w	0·05	2
Wick	30·05	−·18	42	39	+5	—	38	S	5	4	S	7	r c	0·08	4
Nairn	30·01	−·17	38	37	+4	41	33	E	0	2	SW	2	g w	0·01	1
Aberdeen	30·10	−·13	42	42	+9	44	34	S	3	3	S	9	c o	—	2
Leith	30·12	−·14	46	46	+9	47	36	SE	1	2	SW	8	c f	—	
Shields	30·21	−·07	41	39	+2	46	29	SW	3	3	SW	4	c	—	2
Scarborough	30·23	−·07	38	38	−1	47	37	SW	2	3	SW	7	c	—	2
Yarmouth	30·21	+·11	42	41	−2	42	34	E	0	2	NE	0	b	—	3
Ardrossan	30·11	−·13	47	46	+9	47	37	S	0	4	SSE	8	c	0·05	3
Greenock	29·97	−·18	47	47	+7	47	29	SSW	4	4	S	10	r w	0·02	—
Holyhead	30·17	−·12	46	45	+5	48	40	SSE	4	5	SSE	6	c	—	—
Liverpool (Seaforth Dock)	30·26	−·11	46	41	+2	42	40	SSE	2	2	SSE	10	c g	—	2
Valencia	29·95	−·18	52	52	+4	54	47	SSW	5	7	S	9	r w	0·82	4
Roche's Point	30·06	−·10	49	49	0	52	48	SSW	5	5	SSW	9	d c	0·18	4
Pembroke	30·20	−·09	48	46	+4	48	43	S	3	4	S	8	g w	0·02	4
Scilly	30·23	−·07	49	47	+5	50	48	SSW	5	5	SSW	7	c	—	4
Plymouth	30·27	−·06	43	42	+5	50	30	E	1	1	W	3	b	—	1
Portsmouth	30·31	−·02	41	40	0	51	37	ESE	1	3	WSW	6	h w	—	1
Dover	30·31	·00	41	39	−1	47	37	NW	2	3	NNE	2	c b	—	1
London	30·31	−·02	38	36	−3	46	31	E	0	1	NW	10	h f	—	—
Holder	30·31	—	41	—	—	—	—	E	2	—	—	—	—	—	—
Cape Gris Nez	30·28	+·02	42	37	0	50	37	NE	3	3	NNE	8	b o	—	2
Brest	—	—	43	41	+3	53	36	ESE	3	4	NNW	1	b	—	3
L'Orient	30·31	+·02	39	37	−2	50	37	E	4	4	NNE	1	b	—	3
Rochefort	30·28	+·03	41	39	−3	49	38	NE	4	4	N	0	c b	—	3
Biarritz	30·26	+·05	48	44	−4	52	44	E	1	3	N	3	r f b	0·08	3
Coruna	30·29	+·09	49	—	+1	—	—	NE	1	—	—	—	—	—	—
Brussels	30·28	+·03	41	—	−2	—	—	NE	3	—	—	—	c	—	—
Charleville	30·17	−·02	40	—	−4	—	—	NNE	4	—	—	—	b	—	—
Paris	30·26	+·05	38	—	−7	—	—	N	2	—	—	—	b	—	—
Lyons	30·00	—	51	—	+5	—	—	N	3	—	—	—	c	—	—
Toulon	29·88	+·02	49	47	+1	57	48	SSW	1	3	N	9	r c	0·12	6

2 P.M. REPORT.

Skudenæs	30	28	+·01	39	35	+6	—	—	SSE	2	—	—	—	h	—	1
Thurso	29	89	−·11	50	47	+11	—	—	S	6	6	S	7	g	—	3
Scarborough	30	18	−·04	51	47	+11	—	—	SW	3	3	SW	3	b	—	2
Greenocastle	29	89	−·08	51	50	+11	—	—	S	4	2	S	10	fr	—	—
Holyhead	30	10	−·03	50	49	+11	—	—	S	5	4	S	8	c	—	—
Valencia	29	94	−·04	52	50	0	—	—	SSW	6	6	SSW	8	r	—	3
Scilly	30	21	−·01	52	50	+11	—	—	SSW	6	5	SSW	10	c	—	4
London	30	26	−·03	51	46	+16	—	—	SSW	1	0	S	12	b	—	—
Rochefort	30	20	−·04	53	48	+12	—	—	NE	5	—	—	0	b	—	3

EXPLANATION OF COLUMNS.

BAROMETER. The letters r. (rising), f. (falling), and s. (steady), indicate the motion of the mercury in the last 24 hours. **EXTREME WIND** Strongest wind experienced in past 24 hours. **WEATHER.** *Breakfast Room* is h. blue sky; c. detached clouds; d. drizzling rain; f. fog; g. dark, gloomy; l. lightning; m. misty (hazy); o. overcast; p. passing showers; q. squally; r. rain; s. snow; t. thunder; w. ugly, threatening; c. confusedly, scattered fragments; w. wet, damp.

The "change" of barometer and temperature and the "extreme" wind given in the 2 p.m. report are those since 8 a.m.

N.B.—The wind is said to "veer" when its direction changes with the sun, and to "back" when it shifts in the opposite direction.

The Norwegian stations and Fanø do not report rainfall, and their "extreme" wind is an observation taken at 8 p.m.

Figure 3. First *DWR* containing charts, 11 March 1872.

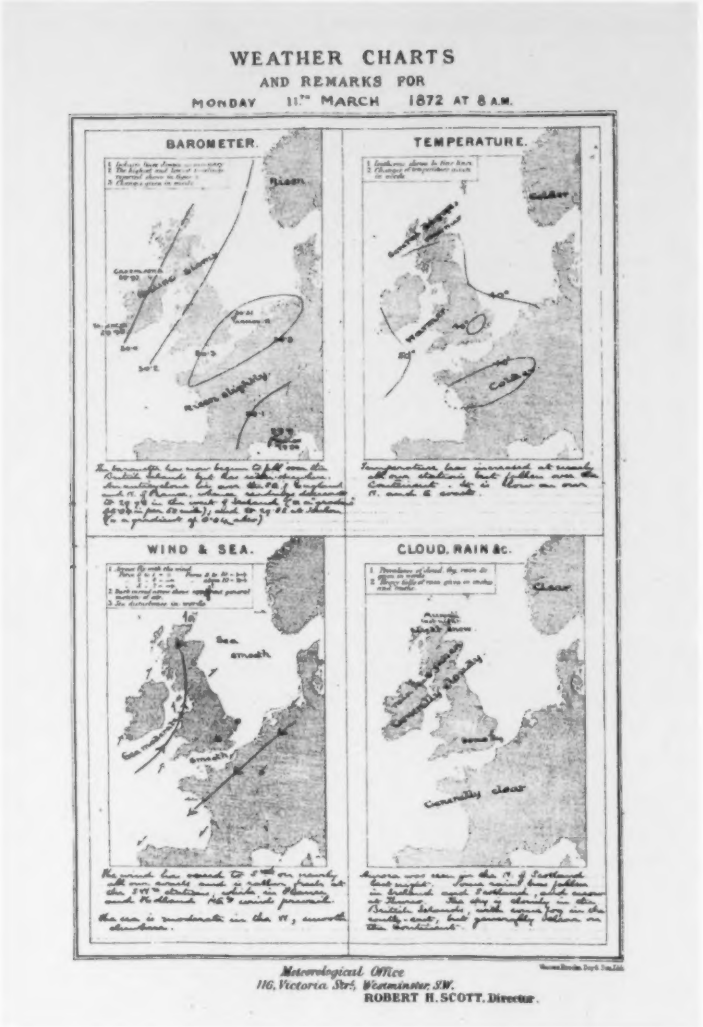
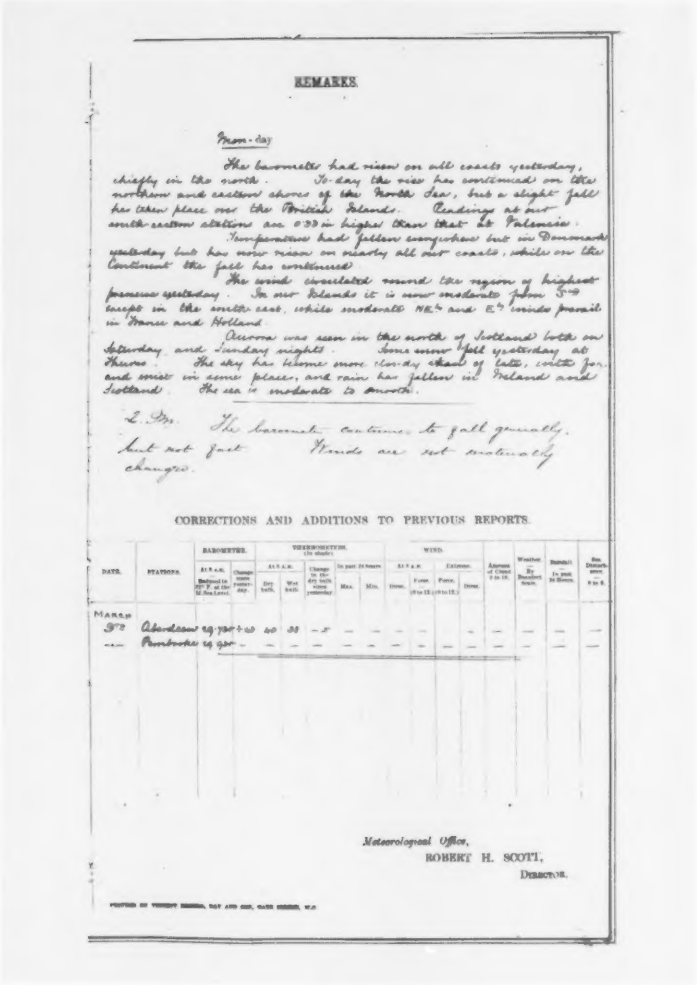


Figure 3 – *continued.*



REMARKS.

Mon. day

The barometer had risen on all coasts yesterday, chiefly in the north. To-day the rise has continued on the northern and eastern shores of the North Sea, but a slight fall has taken place over the British Islands. Readings at most south-eastern stations are 0·3 in higher than at Valencia. Temperatures had fallen everywhere but in Denmark yesterday but has now risen on nearly all our coasts, while on the Continent the fall has continued.

The wind circulated round the region of highest pressure yesterday. In our Islands it is now moderate from S.W. except in the south-east, while moderate N.E.ly and E.ly winds prevail in France and Holland.

Aurora was seen in the north of Scotland both on Saturday and Sunday nights. Some snow fell yesterday at Thurso. The sky has become more cloudy ahead of rain, which has and mist in some places, and rain has fallen in Ireland and Scotland. The sea is moderate to smooth.

2 P.M. The barometer continues to fall generally, but not fast. Winds are not materially changed.

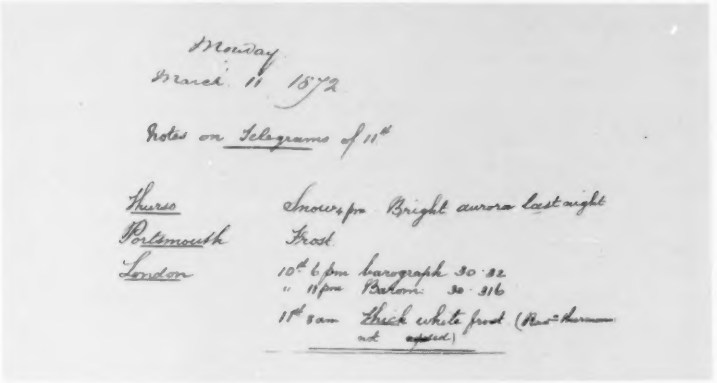
CORRECTIONS AND ADDITIONS TO PREVIOUS REPORTS.

DATE.	STATIONS.	BAROMETER. At 9 A.M. Reduced to 32° F. at Sea Level.	BAROMETER. At 9 A.M. Change since yesterday.	THERMOMETER. (In shade.) At 9 A.M. Dry bulb.	THERMOMETER. (In shade.) At 9 A.M. Wet bulb.	THERMOMETER. (In shade.) At 9 A.M. Change in the last 24 hours since yesterday.	THERMOMETER. In past 24 hours. Max.	THERMOMETER. In past 24 hours. Min.	WIND. At 9 A.M. Force. (0 to 12.)	WIND. At 9 A.M. Direct.	WIND. Extreme. Force. (0 to 12.)	WIND. Extreme. Direct.	Amount of Cloud 0 to 10.	Weather. By Beaufort Notch.	Rainfall. In past 24 Hours.	Sun. Duration since 9 to 9.
MARCH 3rd	Aberdeen 9 yesterday	30	40	38	−5	—	—	—	—	—	—	—	—	—	—	—
"	Pembroke 9 yesterday	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Meteorological Office,
ROBERT H. SCOTT,
DIRECTOR.

PRINTED BY WESLEY BROWN, PAT AND SON, GATE STREET, W.C.

Figure 3 - *continued.*


Monday
March 11 1872

Notes on Telegrams of 11th

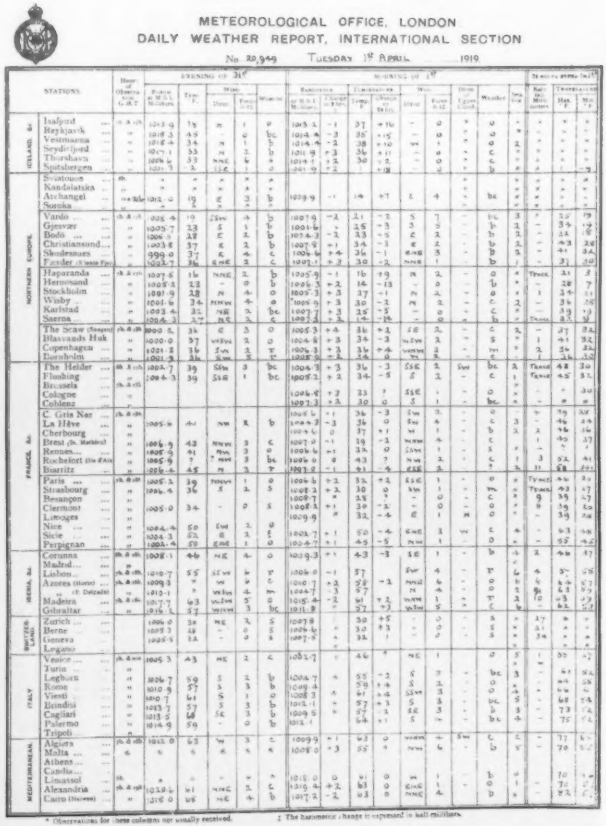
Thurso — Snows pm Bright aurora last night
Portsmouth — Frost
London — 10h 6pm barograph 30·32
" 11pm Barom. 30·316
18h 9am Thick white frost (Rad. thermom. not exposed)

Figure 3 – *continued.*

The *Daily Weather Report* had, from the earliest days, continually enlarged its coverage of weather information from both home and overseas. After the end of the War the amount of extra information had become so large that the *Report* was split into three parts: British, International, and Upper Air; the first issues in the new style were made on 1 April 1919. The British Section contained surface charts for 07 GMT only (as well, of course, as tabulated data), but the International Section contained charts drawn at six-hourly intervals, two covering the British Isles only, and two covering Europe and the eastern Atlantic. On 1 March 1930, the British Section underwent a major modification with the introduction of a new chart covering most of the northern hemisphere; plotted observations were not, however, synchronous, but varied over a wide range from e.g. 07 GMT in western Europe to 19 GMT of the previous day at 180° E. (A fully synchronous northern hemisphere chart seems not to have been achieved until 1949.) During the 1939–45 War, all these publications, though printed regularly, were classified as Secret; they were declassified soon after the War ended. The International Section ceased publication on 31 December 1949, and on 1 January 1950 the Upper Air Section was renamed the *Daily Aerological Record (DAR)*; as compensation for the loss of the old International Section the British Section introduced charts drawn at six-hourly intervals. On 1 January 1951 publication began of an *Overseas Supplement* to the *Daily Weather Report* which contained data for Meteorological Office stations overseas; this *Overseas Supplement* continued to be printed until 31 December 1972. The inclusion of upper-air charts in the *DAR* ended on 31 December 1975, which thereafter contained tabulated data only.

Forecasts 'for Great Britain and Northern Ireland until noon tomorrow' together with an outlook for the following 24 hours continued to be included in the *DWR* until 31 December 1966 but from then on were dropped, the chance of a *DWR* reaching any subscriber on the day of issue having long since become effectively zero.

With the issues of the *Daily Weather Report* and *Daily Aerological Record* for 31 December 1980, and of the *Monthly Summary* for December 1980, the work of the local HMSO Press at the Meteorological Office, Bracknell ceased.



METEOROLOGICAL OFFICE, LONDON
DAILY WEATHER REPORT, INTERNATIONAL SECTION

No. 20,949 TUESDAY 1st APRIL 1919

EVENING OF 31st — MORNING OF 1st

STATIONS	Hour of Observation G.M.T.	Pressure in M.S.L. Millibars	Wind Direction	Wind Force	Weather	Barometer Change in 3 hours	Temperature Dry Bulb	Temperature Wet Bulb	Temperature Diff.	Wind Direction	Wind Force	Weather	Rain in 24 hours	Temperature Max.	Temperature Min.
ICELAND, &c.															
Isafjord	8 a.m.	1013·9	ENE	2		+1·6	37	35	2		0				
Reykjavik	"	1018·2	NNE	2	bc	+0·5	36	35	1		0				
Vestmanna	"	1014·4	ENE	1	b	+1·0	38	35	3	W	1		0		
Seydisfjord	"	1017·1	SE	1	b	+1·1	36	34	2		0		0·2		
Thorshavn	"	1018·4	ESE	2	b	+1·1	38	36	2		0		0·1		
Spitsbergen	"	1021·3	SE	1	c	+1·8	32	32	0		0				
NORTHERN EUROPE															
Sviatonos	8h.														
Kandalaksha	"														
Archangel	10 a.m.	1012·2	SE	3	b	+0·9	34	32	2		0				
Soroka	"														
Vardo	8 a.m.	1025·4	ESE	4	b	+0·8	29	27	2	S	3		0·2	32	29
Gjesvaer	"	1005·7	SE	5	b	+0·1	26	23	3	S	3		0·2	34	28
Bodö	"	1006·3	SE	2	b	+0·4	33	30	3	S	2		0·1	38	28
Christiansund	"	1003·8	ESE	4	b	+0·7	34	32	2	S	2		0·3	40	28
Skudesnaes	"	999·0	SE	6	c	+0·6	36	34	2	ESE	3		0·2	41	34
Feander (Christiansund)	"	1003·7	SE	2	c	+0·1	30	28	2	NNE	1		0·1	37	30
Haparanda	8 a.m.	1027·6	NE	2	b	+0·9	23	23	0		0		Trace	32	21
Hernosand	"	1028·3	ESE	1	b	+0·5	36	34	2		0		0·2	38	27
Stockholm	"	1031·9	ESE	2	b	+0·3	37	36	1		0		0·1	40	32
Visby	"	1031·6	ESE	3	b	+0·3	39	38	1		0		0·2	42	34
Karlstad	"	1030·4	SE	2	b	+0·2	36	34	2		0		0·1	40	33
Saenna	"	1030·3	SE	2	b	+0·2	36	34	2		0		0·1	40	33
The Scaw (Skagen)	8 a.m.	1030·5	SE	3	b	+0·2	36	34	2		0		0·1	40	34
Blavands Huk	"	1030·0	SE	3	b	+0·2	36	34	2		0		0·1	40	34
Copenhagen	"	1031·8	SE	2	b	+0·3	36	34	2		0		0·1	40	34
Hornholm	"	1031·3	SE	2	b	+0·3	36	34	2		0		0·1	40	34
FRANCE, &c.															
The Helder	8 a.m.	1032·7	SSW	3	bc	+0·3	34	32	2	SSE	2	SW	bc	2	Trace	42	30
Flushing	"	1031·3	SSE	1	bc	+0·2	36	34	2	SE	2		c	1	Trace	45	31
Brussels	8 a.m.																
Cologne	"																
Coblenz	"																
C. Gris Nez	8 a.m.																
La Hève	"	1035·9	ENE	NW	2	b	+0·3	34	32	2	SE	2		0		44	30
Cherbourg	"																
Brest (St. Mathieu)	"	1034·9	ESE	NNW	3	c	+0·2	36	34	2	W	4		c	3	46	34
Rennes	"	1032·6	ESE	NW	3	c	+0·1	34	32	2	W	4		c	1	46	34
Rochefort (Ile d'Aix)	"	1032·6	E	NW	3	bc	+0·0	43	38	5	W	4		c	3	52	41
Biarritz	"	1031·6	ESE	N	3	c	+0·1	41	36	5	ESE	4		c	1	52	41
Paris	8 a.m.	1035·3	SE	NNW	1	b	+0·2	34	32	2	SSE	1		0		Trace	44	32
Strasbourg	"	1034·4	SE	S	2	b	+0·2	38	36	2	W	1		0		Trace	43	27
Besançon	"						+0·1	33						0		8	38	27
Clermont	"	1035·0	SE		0	b	+0·1	38	35	3		0		0			39	30
Limoges	"						+0·1	32	30	2		0		0			39	28
Nice	"	1034·4	SE	ENE	2	b												
Sicie	"	1034·3	SE	E	3	b	+0·1	50	46	4	ENE	3	W	c	4		43	34
Perpignan	"	1034·4	SE	ENE	1	b	+0·1	50	46	4	ENE	1		0			52	42
IBERIA, &c.																		
Coruna	8 a.m.	1038·1	ESE	NE	4	b	+0·3	63	58	5	SE	1		b	2	68	47	
Madrid	"																	
Lisbon	8 a.m.	1040·7	SSE	SSW	4	b	+0·1	57			SW	4		b	4	57	52	
Azores (Horta)	8 a.m.	1039·3	E	W	4	c	+0·2	58	52	6	NNE	4		b	4	63	52	
" (S. Delgada)	"	1039·1	E	WSW	4	m	+0·3	57			N	4		0	2	63	52	
Madeira	8 a.m.	1037·7	ESE	WSW	5	b	+0·2	61	57	4	WSW	5		c	2	70	52	
Gibraltar	"	1036·3	ESE	WNW	3	bc	+0·2	57	52	5	WSW	5		c	2		52	
SWITZERLAND																		
Zurich	8 a.m.	1026·0	SE	NE	2	b	+0·2	32	30	2		0		b	2	47	28	
Berne	"	1025·3	SE		0	b	+0·2	32	30	2		0		b	2	46	28	
Geneva	"	1025·5	SE		0	b	+0·2	34	32	2		0		b	2	54	30	
Lugano	"																	
ITALY																		
Venice	8 a.m.	1025·3	ESE	NE	2	c	+0·2	46	42	4	NE	1		b	2	58	42	
Turin	"																	
Leghorn	"	1026·7	SSE	S	2	b	+0·2	50	46	4	S	3		bc	3	61	44	
Rome	"	1030·9	SSE	S	3	b	+0·2	54	50	4	S	2		b	2	66	48	
Viesti	"	1030·7	SSE	S	3	b	+0·2	54	50	4	SSW	3		b	2	66	48	
Brindisi	"	1031·7	SSE	S	3	b	+0·2	54	50	4	S	3		bc	3	68	48	
Cagliari	"	1031·5	SE	SE	3	b	+0·2	54	50	4	SE	3		b	3	72	48	
Palermo	"	1031·9	SSE		0	b	+0·2	54	50	4		0		b	2	70	48	
Trapani	"																	
MEDITERRANEAN																		
Algiers	8 a.m.	1033·0	SSE	W	3	c	+0·2	63	58	5	WSW	4	SW	c	4	72	54	
Malta	"						+0·3	55			NW	4		b	2	70	52	
Athens	"																	
Candia	"																	
Limassol	"						+0·2	61	57	4		1		b	2	70	54	
Alexandria	8 a.m.	1029·6	NE	NNE	3	c	+0·2	63	59	4	ENE	2		b	2	72	54	
Cairo (Heliopolis)	"	1030·0	SSE	NE	2	b	+0·2	63	59	4	NNE	2		b	2	73	54	

* Observations for these columns not usually received.

‡ The barometric change is expressed in half-millibars.

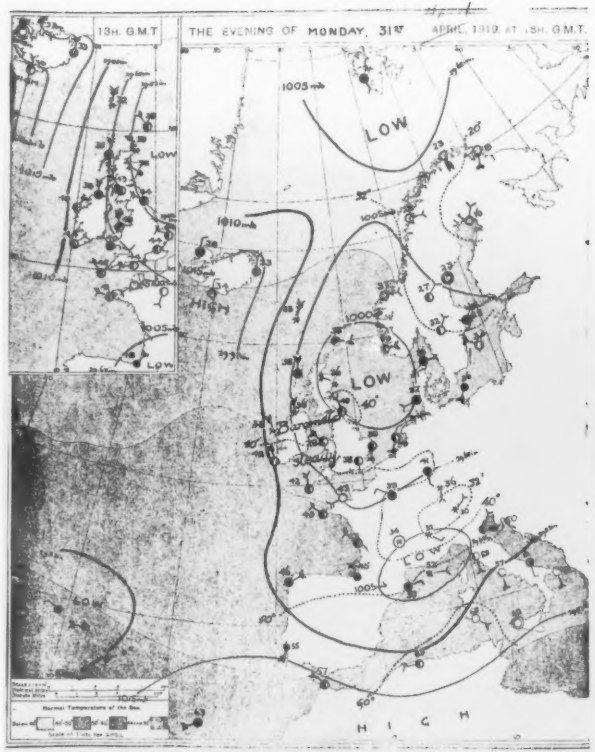
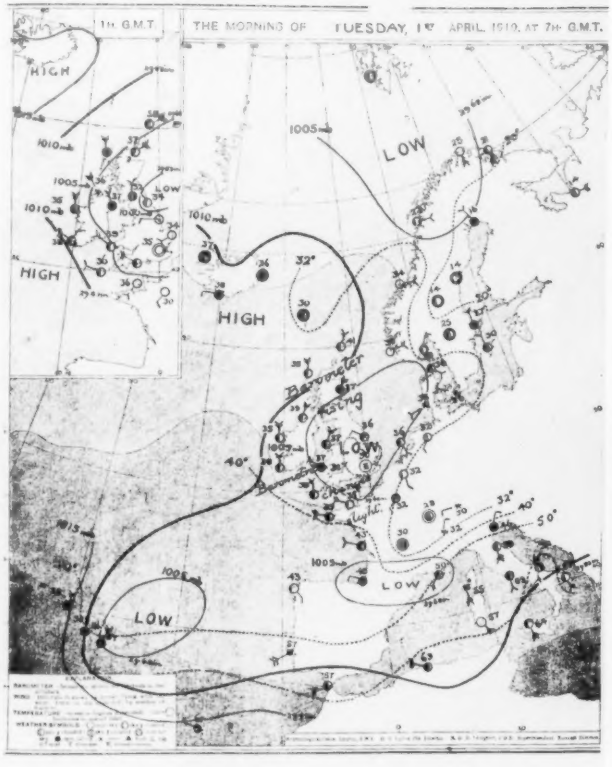
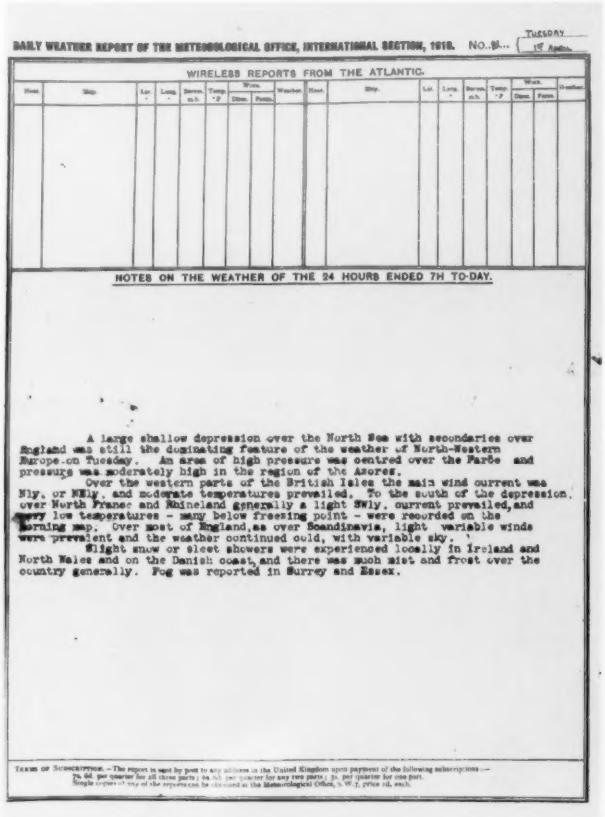


Figure 4. First issue of *DWR* split into three parts – International, British and Upper Air – 1 April 1919.





DAILY WEATHER REPORT OF THE METEOROLOGICAL OFFICE, INTERNATIONAL SECTION, 1919. NO. 91... TUESDAY 1st April.

WIRELESS REPORTS FROM THE ATLANTIC.

Hour.	Ship.	Lat. °	Long. °	Barom. m.b.	Temp. °F	Wind. Direc.	Wind. Force.	Weather.	Hour.	Ship.	Lat. °	Long. °	Barom. m.b.	Temp. °F	Wind. Direc.	Wind. Force.	Weather.

NOTES ON THE WEATHER OF THE 24 HOURS ENDED 7H TO-DAY.

A large shallow depression over the North Sea with secondaries over England was still the dominating feature of the weather of North-Western Europe on Tuesday. An area of high pressure was centred over the Fardo and pressure was moderately high in the region of the Azores.

Over the western parts of the British Isles the main wind current was Nly. or NEly. and moderate temperatures prevailed. To the south of the depression over North France and Rhineland generally a light SWly. current prevailed, and very low temperatures - many below freezing point - were recorded on the morning map. Over most of England, as over Scandinavia, light variable winds were prevalent and the weather continued cold, with variable sky.

Slight snow or sleet showers were experienced locally in Ireland and North Wales and on the Danish coast, and there was much mist and frost over the country generally. Fog was reported in Surrey and Essex.

TERMS OF SUBSCRIPTION.—The report is sent by post to any address in the United Kingdom upon payment of the following subscriptions:—
3s. 6d. per quarter for all three parts; 2s. 6d. per quarter for any two parts; 1s. per quarter for one part.
Single copies of any of the reports can be obtained at the Meteorological Office, S. W. 7, price 1d. each.

Figure 4 – *continued.*

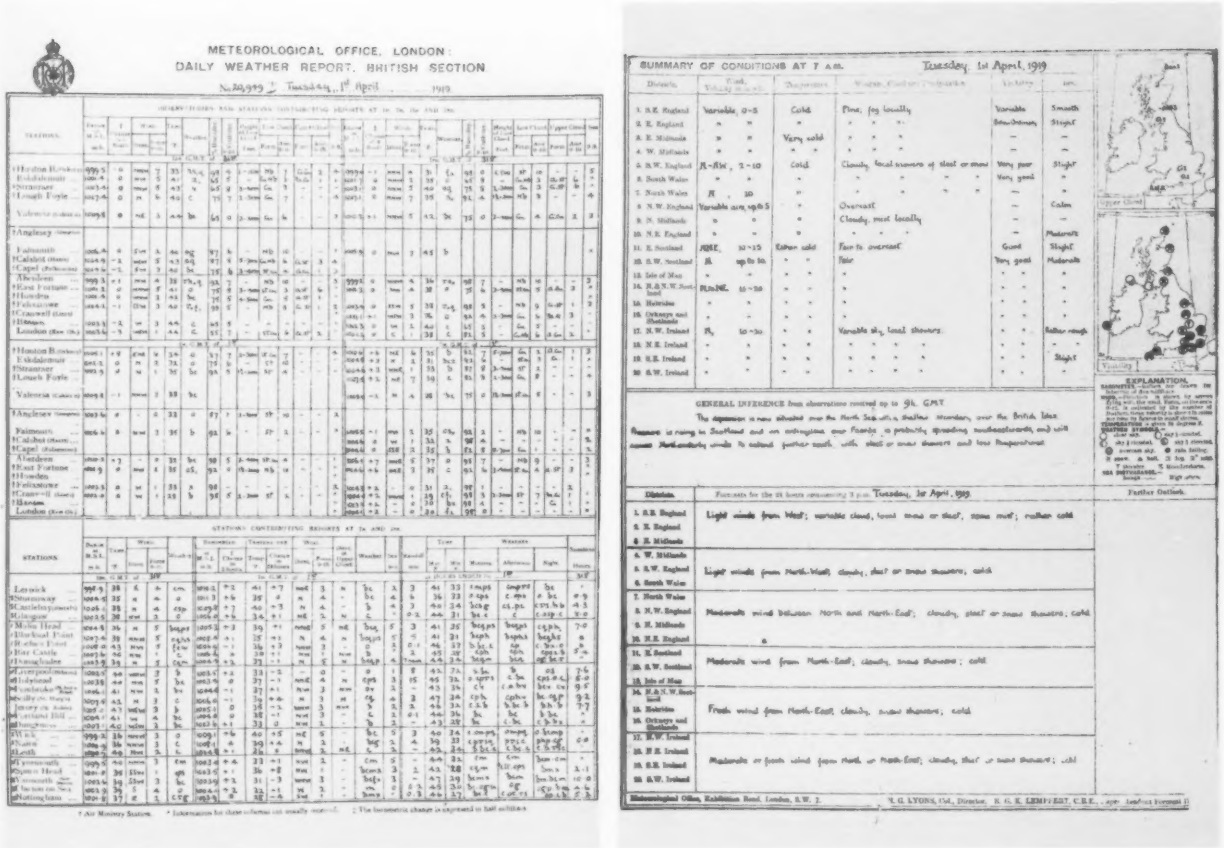

METEOROLOGICAL OFFICE, LONDON
DAILY WEATHER REPORT, BRITISH SECTION
No. 249,999 Tuesday, 1st April 1919
STATIONS CONTRIBUTING REPORTS AT 7a AND 7p.
SUMMARY OF CONDITIONS AT 7 a.m. Tuesday, 1st April, 1919
GENERAL INFERENCE from observations received up to 9h. G.M.T.
The depression a new situated over the North Sea with a shallow secondary over the British Isles
Pressure is rising in Scotland and an anticyclone over France is probably spreading southeastwards and will
cause North-easterly winds to extend further south, with sleet or snow showers and low temperatures
EXPLANATION.
Forecasts for the 24 hours commencing 7 p.m. Tuesday, 1st April, 1919.
Further Outlook.
1. S.E. England
2. E. England
3. E. Midlands
4. W. Midlands
5. S.W. England
6. South Wales
7. North Wales
8. N.W. England
9. N. Midlands
10. N.E. England
11. E. Scotland
12. N.W. Scotland
13. Isle of Man
14. N. & N.W. Scotland
15. Hebrides
16. Orkneys and Shetlands
17. N.W. Ireland
18. N.E. Ireland
19. S.E. Ireland
20. S.W. Ireland
Light winds from West; variable cloud, local snow or sleet, some mist; rather cold
Light winds from North-West; cloudy, sleet or snow showers, cold
Moderate wind between North and North-East; cloudy, sleet or snow showers; cold
Moderate wind from North-East; cloudy, snow showers; cold
From wind from North-East, cloudy, snow showers; cold
Moderate or fresh wind from North or North-East; cloudy, sleet or snow showers; cold
Meteorological Office, Exhibition Road, London, S.W. 7.
R. G. K. LEMPFERT, C.B.E.

Figure 4 – *continued.*

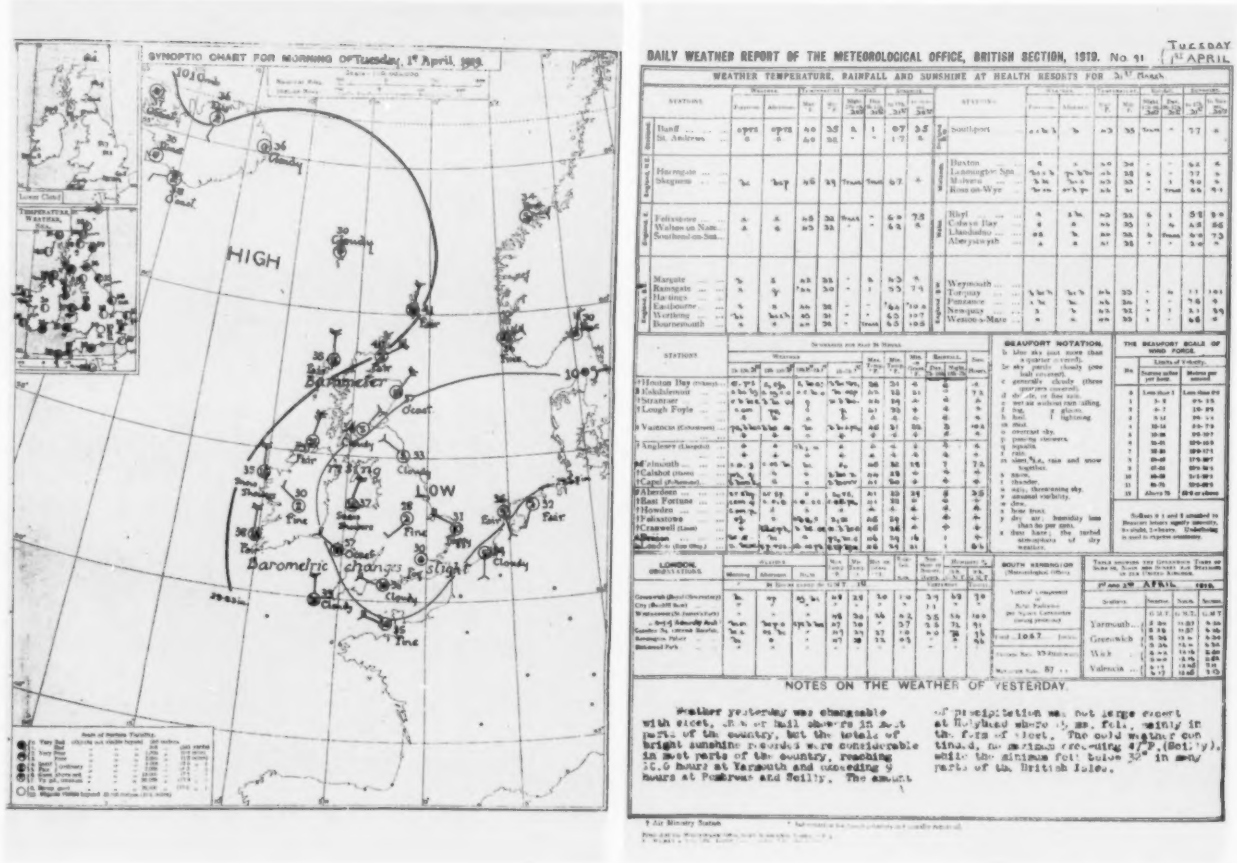

SYNOPTIC CHART FOR MORNING OF Tuesday, 1st April, 1919.
HIGH
LOW
Barometer
Rising
Barometric changes Slight
DAILY WEATHER REPORT OF THE METEOROLOGICAL OFFICE, BRITISH SECTION, 1919. No. 91
TUESDAY 1ST APRIL
WEATHER TEMPERATURE, RAINFALL AND SUNSHINE AT HEALTH RESORTS FOR 31ST March.
BEAUFORT NOTATION.
THE BEAUFORT SCALE OF WIND FORCE.
LONDON
SOUTH KENSINGTON
APRIL 1919.
NOTES ON THE WEATHER OF YESTERDAY.
Weather yesterday was changeable with sleet, snow or hail showers in most parts of the country, but the totals of bright sunshine recorded were considerable in most parts of the country, reaching 10.6 hours at Yarmouth and exceeding 9 hours at Pembrey and Reilly. The amount of precipitation was not large except at Highland where 0.5 in. fell, mainly in the form of sleet. The cold weather continued, the maximum reading 47°F. (Scilly), while the minimum fell below 32° in many parts of the British Isles.

Figure 4 – *continued.*

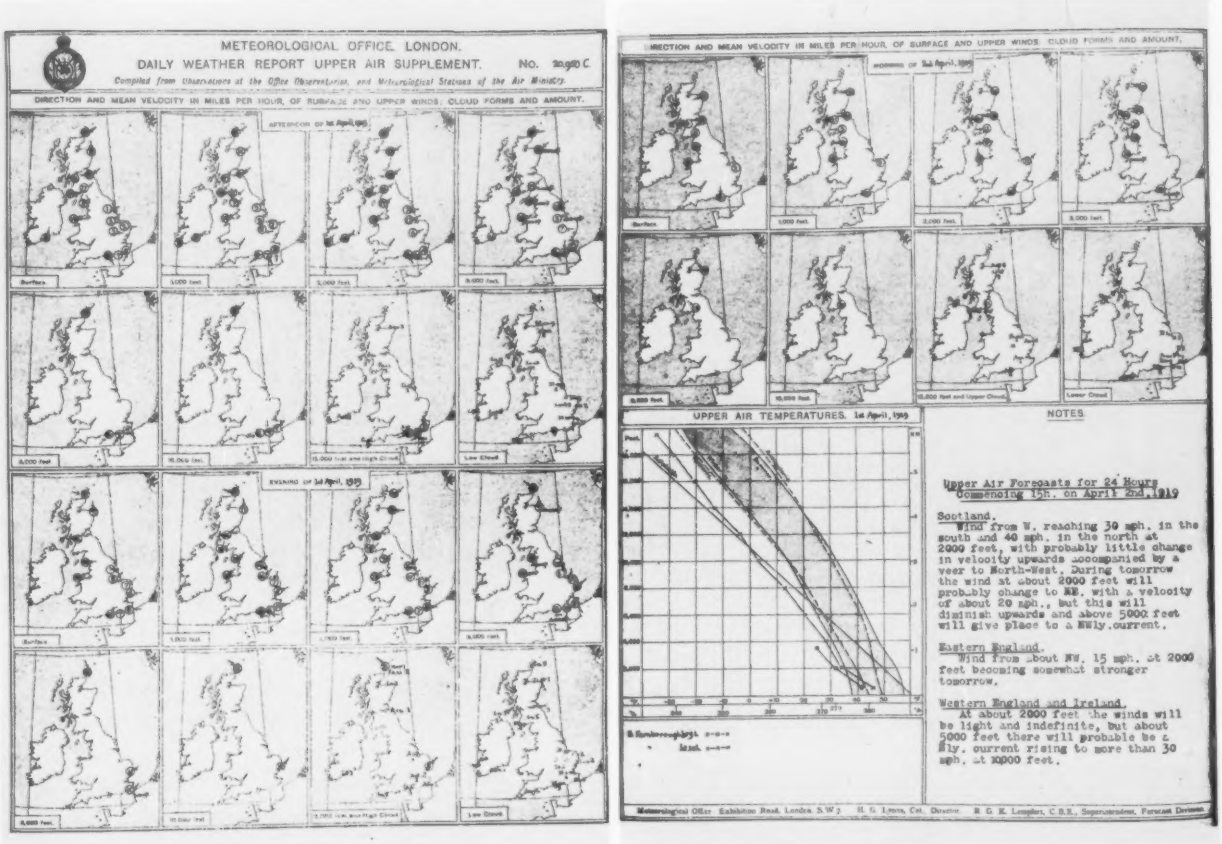

METEOROLOGICAL OFFICE. LONDON.
DAILY WEATHER REPORT UPPER AIR SUPPLEMENT. No. 20,980 C.
Compiled from Observations at the Office Observatories, and Meteorological Stations of the Air Ministry.
DIRECTION AND MEAN VELOCITY IN MILES PER HOUR, OF SURFACE AND UPPER WINDS. CLOUD FORMS AND AMOUNT.
AFTERNOON OF 1st April, 1919
EVENING OF 1st April, 1919
UPPER AIR TEMPERATURES. 1st April, 1919
NOTES
Upper Air Forecasts for 24 Hours
Commencing 15h. on April 2nd, 1919
Scotland.
Wind from W. reaching 30 mph. in the south and 40 mph. in the north at 2000 feet, with probably little change in velocity upwards accompanied by a veer to North-West. During tomorrow the wind at about 2000 feet will probably change to NE., with a velocity of about 20 mph., but this will diminish upwards and above 5000 feet will give place to a NWly.current.
Eastern England.
Wind from about NW. 15 mph. at 2000 feet becoming somewhat stronger tomorrow.
Western England and Ireland.
At about 2000 feet the winds will be light and indefinite, but about 5000 feet there will probable be a Sly. current rising to more than 30 mph. at 10000 feet.
Meteorological Office Exhibition Road, London S.W.7. H. G. Lyons, Col. Director. R. G. K. Lempfert, C.B.E., Superintendent, Forecast Division.

Figure 4 – *continued.*

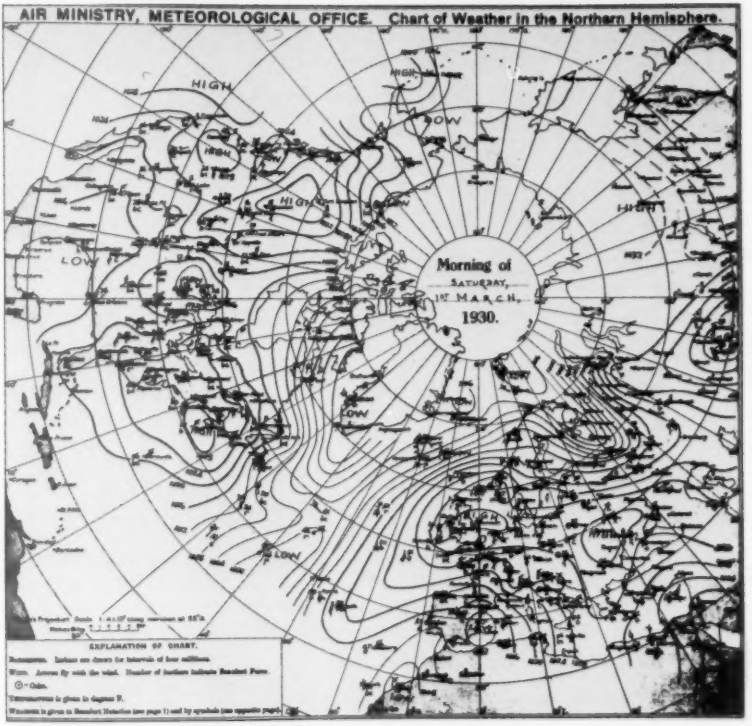


Figure 5. First *DWR* containing chart of northern hemisphere, 1 March 1930.

The circulation of the *DWR* and its sister publications was not large, never, it seems, having exceeded three figures. It is difficult to find evidence of the numbers issued in the past, but occasional pieces of information do occur in the Minutes of the Meteorological Committee. For example:

in November 1907, about 580 *DWR*s were posted each day;
the plan for 1910–11 envisaged a printing of 650–700;
in May 1915, 650 copies were 'received' and 539 'issued', a remark being inserted in the Minutes that the 'issue [was] restricted on account of War conditions';
in 1919 it was proposed that in 1920 the numbers produced of the British, International, and Upper Air sections should be 800, 300, and 800 respectively.

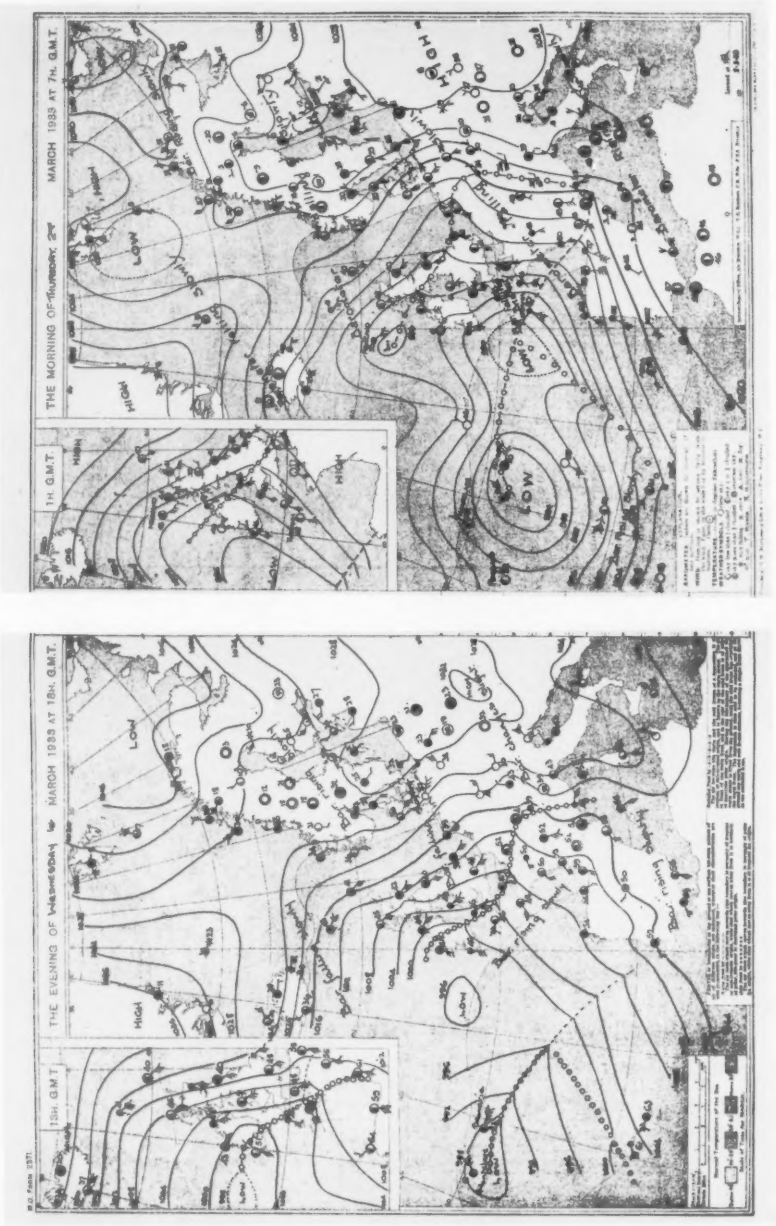


Figure 6. Charts from International Section of *DWR* for 1 March 1933. This was the first time that fronts appeared on the charts.

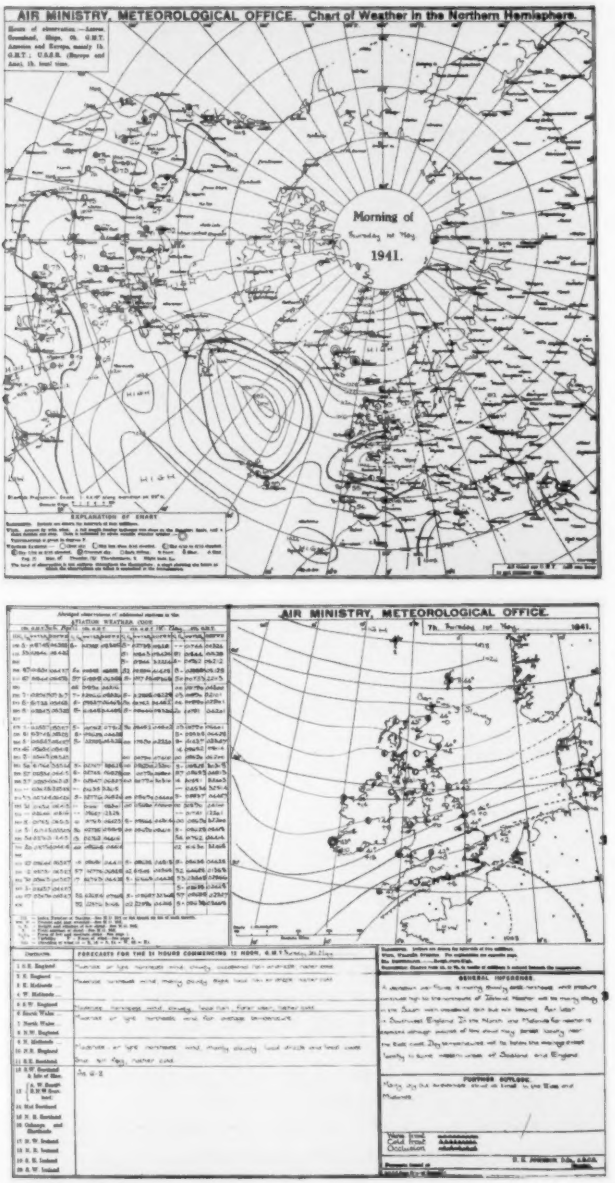


Figure 7. Charts from British Section of *DWR* for 1 May 1941, showing first appearance of fronts on British Isles charts.

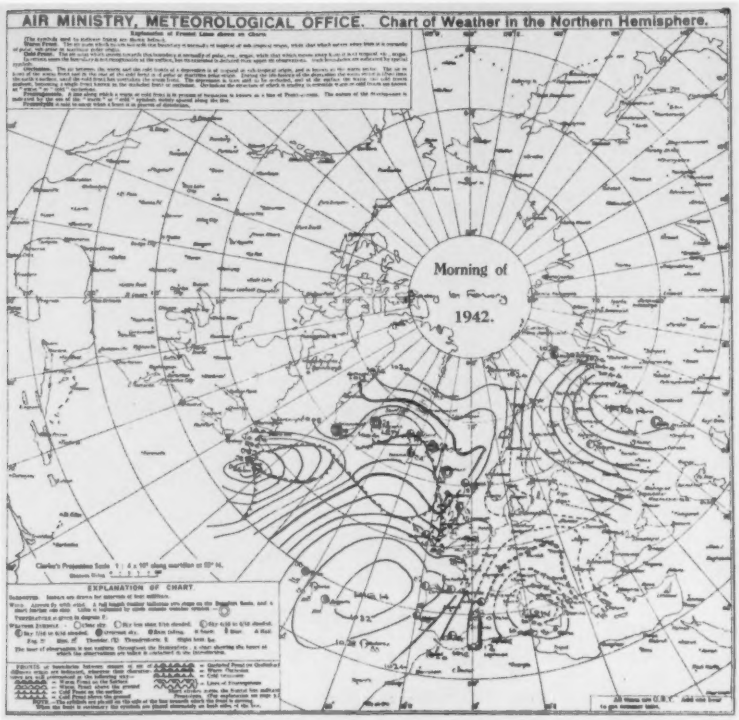


Figure 8. First northern hemisphere chart on which front appeared, from British Section of *DWR*, 1 February 1942.

In 1980, just before publication ceased, nearly 500 were distributed, 266 going to paying customers and 223 being issued free. Paying customers were largely made up of educational institutions and libraries; there were hardly any private subscribers. Of the free issue, 99 were used by the Meteorological Office, 5 went to the Royal Navy, 5 to lighthouses and coastguard stations, 26 to other Government departments and major museums, 5 to the copyright libraries, 15 to schools, colleges and universities (mainly those of an official nature such as Dartmouth and Sandhurst, or schools of navigation, or those associated with a meteorological observing station), 57 to foreign countries on exchange agreements, and 11 to miscellaneous addressees who had close connections with the Office. The *DAR* had about 51 paying customers — mainly universities and other centres of higher education — and about 120 copies were issued free, including those for Meteorological Office use.

It has, of course, been impossible to describe, let alone illustrate, all the minor changes of style and content that have occurred over 120 years, but a very full account of these variations was prepared in 1961 by E. Cayhill, and a typescript copy is kept in the National Meteorological Library at Bracknell where it may be consulted.

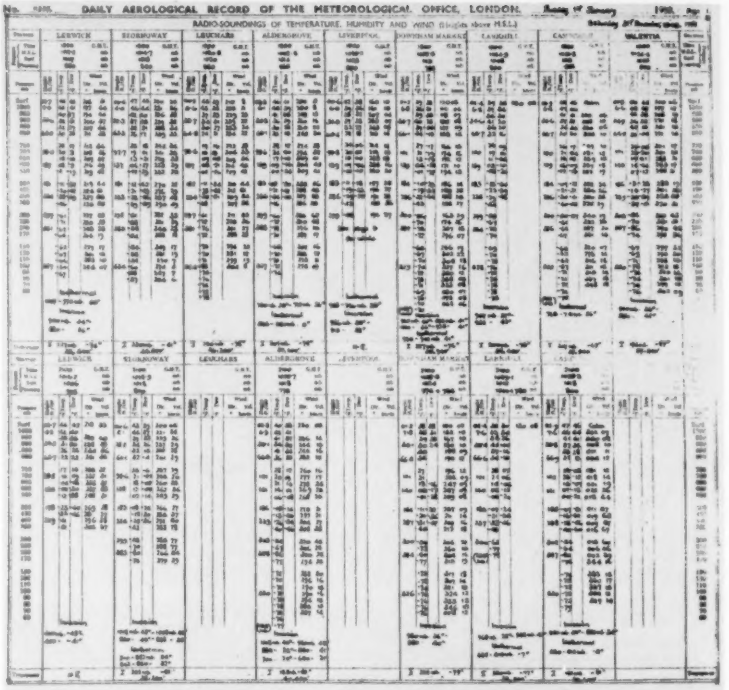
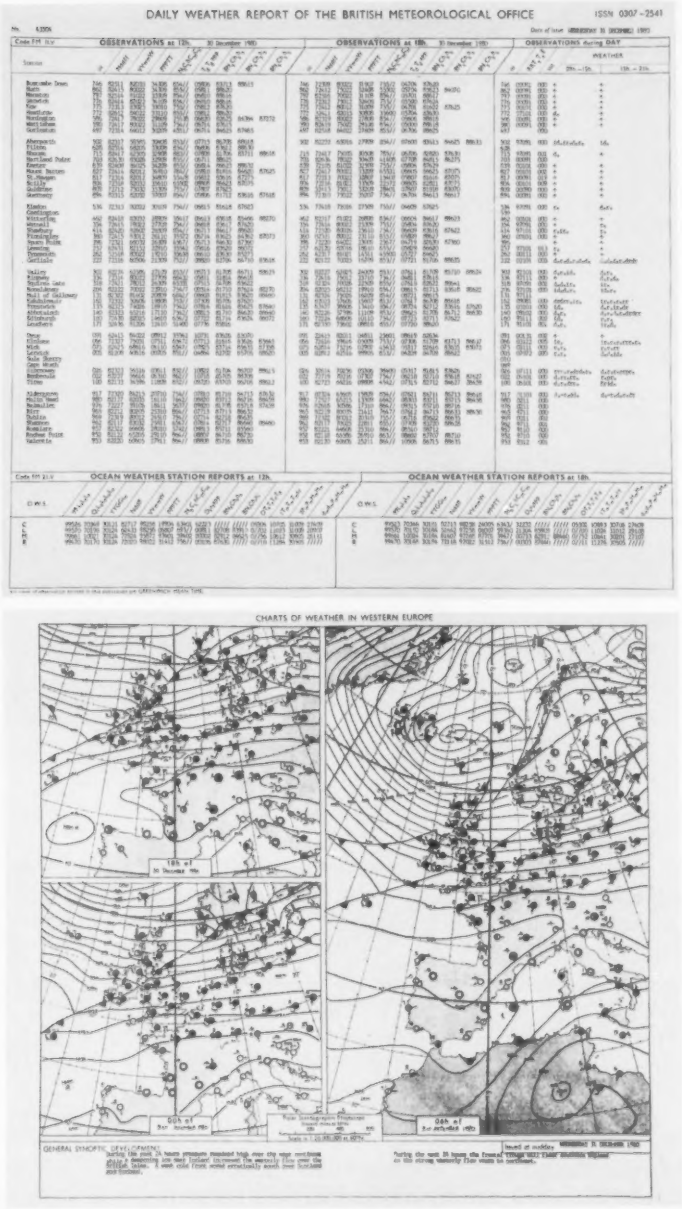


Figure 9. First issue of *Daily Aerological Record*, 1 January 1950.

One topic does, however, warrant some detailed mention, and that is the introduction of the representation of frontal analysis into the published charts. For some peculiar reason, which is unknown to me, fronts were used in the charts of the International Section more than eight years before they appeared in the British Section. The issue of the former dated 1 March 1933 bore a legend referring to fronts and introducing the symbolism ----- for a warm front, ooooo for a cold front, and -o-o-o- for an occlusion; fronts appeared for the first time on the 18 GMT chart for 1 March 1933 printed on the issue dated 2 March. (Modern symbolism was introduced on 1 January 1937, possibly as one result of an extended visit paid to the Meteorological Office by Professor J. Bjerknes from December 1935 to May 1936 when he instructed the senior forecasting staff of the Office in the latest methods of the Norwegian school.)

In the British Section, though isobars in troughs were kinked more and more sharply from the mid 1930s onwards, fronts themselves were not represented until 1 May 1941, and then only on the small British Isles chart; they did not appear on the northern hemisphere chart until 1 February 1942.



DAILY WEATHER REPORT OF THE BRITISH METEOROLOGICAL OFFICE

ISSN 0307-2541

OBSERVATIONS at 12h. 30 December 1980

OBSERVATIONS at 18h. 30 December 1980

OBSERVATIONS during DAY

OCEAN WEATHER STATION REPORTS at 12h.

OCEAN WEATHER STATION REPORTS at 18h.

CHARTS OF WEATHER IN WESTERN EUROPE

GENERAL SYNOPTIC DEVELOPMENTS

Figure 10. Last issue of *DWR*, 31 December 1980.

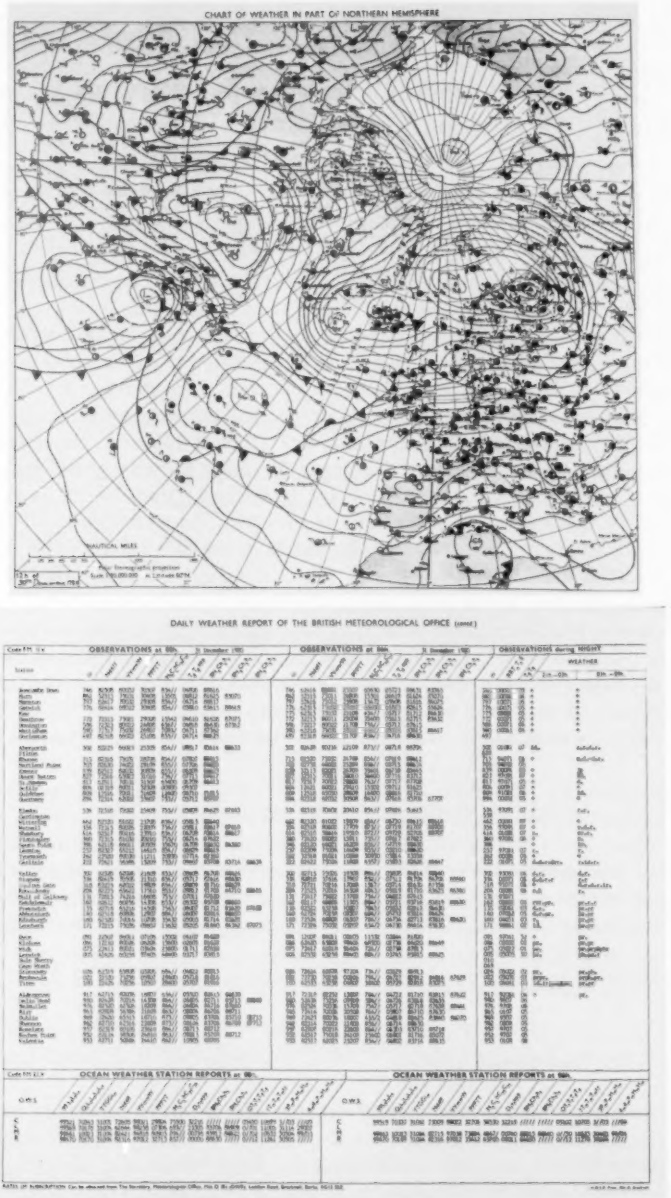


CHART OF WEATHER IN PART OF NORTHERN HEMISPHERE
DAILY WEATHER REPORT OF THE BRITISH METEOROLOGICAL OFFICE (cont.)
OBSERVATIONS at 0900
OBSERVATIONS at 1800
OBSERVATIONS during NIGHT
OCEAN WEATHER STATION REPORTS at 0900
OCEAN WEATHER STATION REPORTS at 1800

Figure 10 – *continued.*

551.593.653

Noctilucent clouds over western Europe during 1981

By D.H. McIntosh and Mary Hallissey
(Department of Meteorology, University of Edinburgh)

Table I summarizes the observations of noctilucent cloud (NLC) over western Europe during 1981, as reported to the Department of Meteorology, University of Edinburgh.

The times given in the second column of the Table do not necessarily indicate the duration of the display, though appearance and disappearance times are referred to in the Notes where known. In the third column brief notes of the displays enlarge on the facts listed in other columns — NLC forms discernible, tropospheric cloud conditions, photographs and sketches available. Co-ordinates of the observing stations and selected details of elevation and azimuth appear in the remaining columns.

Routine hourly observations were made at 13 meteorological stations in the United Kingdom, 3 in Sweden and when darkness permitted at Reykjavik in Iceland. Observers at these stations provide information of sky conditions during all hours of darkness; the significance of 'negative' nights is obviously great when trying to assess the overall appearances of NLC. It is, however, always remarkable and much appreciated that in many instances NLC is recognized when quite large amounts of tropospheric cloud — in fact, up to seven oktas — are present.

The usually accepted peak occurrence periods — the last two weeks of June and the first two weeks of July — were very cloudy in 1981. During this period few instances occurred where observing conditions permitted with any degree of confidence the statement 'no NLC' to be made. According to the film taken at Edinburgh (automatic exposures at 15-minute intervals throughout) the nights 15/16, 16/17 and 27/28 June were clear; several hourly observing stations were sufficiently clear to back up these negative observations.

Positive observations of NLC were received from 13 hourly observing stations, 3 other United Kingdom meteorological stations, 3 Swedish stations, the Icelandic station, a Swiss observatory, and from voluntary observers in Edinburgh, Milngavie, Newton Stewart, Stevenston, Fiane (Norway) and Turku (Finland). On occasions, the observation points were well scattered. Many of the observations were accompanied by sketches, and the list at the end of the report summarizes the many photographs taken. Details of these are available if required. Positive reports occurred on 41 nights. This number compares with 32 in 1980 and 43 in 1979.

The most outstanding and widely reported displays occurred on 6/7, 21/22, 22/23, 28/29 June, 8/9 and 9/10 July.

A selection of photographs and a graphic compilation of the data received over the years 1970–81 were on display at the International Union of Geodesy and Geophysics conference held in Edinburgh in August 1981.

The help and co-operation of the many observers who were fortunate enough to see NLC and of the many more who watched in vain are gratefully acknowledged. A grant from the Meteorological Office makes possible the collection, collation and publication of the written and photographic data. All the data published here and elsewhere have been incorporated by Dr Fast of the University of Tomsk into his catalogue of NLC data.

Table I. *Displays of noctilucent clouds over western Europe during 1981*

Date — night of		Times UT	Notes	Station position*		Time UT	Max. elev.	Limiting azimuths degrees
1981								
19/20	May	2300	Possible NLC seen from neighbouring stations [Kirkwall & Wick] in breaks in tropospheric cloud.	59°N	03°W	2300		
		0100		58.5°N	03°W	0100		
26/27		2300	Possible faint NLC visible from SW Scotland.	55°N	04.5°W	2300		
6/7	June	2245–0300	Widespread display of NLC, first visible in south at Boulmer, and last seen from Tiree. The delicate formation of bands and denser patches against a veil background show up well in sketches from Kinloss and Edinburgh, and in photographs from Edinburgh and Joppa. Maximum elevation to 24° at Kinloss, to 10° at Boulmer and at Tiree. Medium to bright.	57.5°N	03.5°W	0040	24	310–005
				57°N	02°W	2400	–	–
						0100	–	060
				56.5°N	03°W	2400	15	020–030
						0100	14	330–030
				56.5°N	07°W	2400	8	320–360
						0100	10	
				56°N	03°W	2310	15	017–025
						2330	11	– –035
						0015	11	346–011
				55.5°N	01.5°W	2245	7½	350–020
						2340	10	350–020
						0040	10	340–030
						0145	10	010–040
				55°N	01.5°W	0025	4	340–010
						0050	5	350–020
8/9		2400,0100	Possible NLC seen Kinloss, Peterhead and Aldergrove — no details	57.5°N	03.5°W	2400		
				54.5°N	06°W	2400		
						0100		
9/10		2200	Silvery-blue streaks of NLC visible Boulmer above stratocumulus	55.5°N	01.5°W	2200	20	280–040
17/18		0100	NLC seen Kinloss and Tiree in breaks in tropospheric cloud. Extent of display hidden.	57.5°N	03.5°W	0300	–	330,025
		0240–0305		56.5°N	07°W	0100	15	340–360
20/21		2200,2400	Possible small areas of NLC — reported from three stations.	56.5°N	07°W	0100	–	315
				55.5°N	03°W	0100	–	020
		0015,0100		55°N	04.5°W	2215	–	–
						0015	–	–
21/22		0030–0305	Skies sufficiently clear at several stations 2200–2400 to claim 'no NLC'. NLC first seen 0030 in NE England and visible Church Fenton until 0305. Sketch from Kinloss shows bright and very bright patches against veil background, bright bands and fine ripples. Similar detail noted at Newcastle and Boulmer. Visible Church Fenton as veil or silvery streaks on N horizon.	57.5°N	03.5°W	0100	21	320–065
				55.5°N	01.5°W	0030	19	350–030
						0200	19	340–010
				55°N	01.5°W	0050	7	360–050
						0120	12	360–050
						0150	15	360–040
				54.5°N	01.5°W	0100	5	340–020
						0200	5	340–020
				54°N	01°W	0100	–	360
						0300	–	–
22/23		2220–0030	This rather spectacular display reported earliest from Milngavie where a series of photographs was taken. Intensely bright NLC with typical ice blue at higher elevation, yellowing towards horizon. Well defined bands and herring-bone formation reported from Milngavie and Leuchars, also whirls and billow much in evidence from Leuchars, and noted on Edinburgh film. Display visible through breaks in thick tropospheric cloud at Boulmer. Overcast conditions hampered viewing display to its conclusion.	56.5°N	03°W	2300	30	330–030
						2400	20	340–360
				56°N	03°W	0001	15	360
				56°N	04.5°W	2220	42	360
						0025	40	360
				55.5°N	01.5°W	2400	12	330
23/24		2345	Bright silvery bands of NLC seen from Livingston.	56°N	03°W	2345	45	360
25/26		2400,0100	Tiree reported 'no NLC' at 2300 – almost cloudless sky – and again at 0200–0400. At 2400 and 0100 small band of NLC visible there; at 0100 at Ronaldsway faint wisps of NLC visible above low cumulus.	56.5°N	07°W	2400	15	360–020
						0100	15	360–020
				54°N	04.5°W	0100	15	340–020
26/27		2345–0100	Faint NLC thought to be discernible on film at Edinburgh, low N horizon.	56°N	03°W	0100	3	360
28/29		2400–0245	Several stations able to state 'no NLC' before midnight. By 0030 at Leuchars extensive display of NLC with veil, bands, billows and whirl formation, the bands running N–S direction. The NLC spread in south-easterly direction, fading from the north. Detailed sketches from Leuchars and Church Fenton, photographs Edinburgh.	57°N	02°W	0100	–	–
				56.5°N	03°W	0030	28	320–070
						0120	36	320–085
						0220	30	090–175
				56°N	03°W	0100	25	360
				55.5°N	01.5°W	2400	22	340–030
						0100	20	360–365
						0200	30	340–020
				55.5°N	05°W	2400	5	340
				55°N	01.5°W	0045	8	340–020
						0115	12	340–020
				54.5°N	06°W	0100	12	020–050
						0200	–	357,090
				54°N	04.5°W	0100	10	350–030
						0200	25	340–090
				54°N	01°W	0110	8	350–055
						0205	46	350–095

*To nearest 0.5 degree.

Date — night of		Times UT	Notes	Station position*		Time UT	Max. elev.	Limiting azimuths *degrees*
1/2	July	2400	Short-lived appearance of NLC bands in NE seen Dyce ['no NLC' in previous and following hourly observations], and showing as veil on Edinburgh film.	57°N 56°N	02°W 03°W	2400 0015	10 5	045 360
3/4		0045–0200	Sketch from Kinloss depicts NLC bands N–S orientation. From Boulmer and on film from Edinburgh NLC seen in breaks in tropospheric cloud.	57.5°N 56°N 55.5°N	03.5°W 03°W 01.5°W	0100 0030 0100 0200	35 24 15 8 15	360 040 360 340 360
4/5		2030–0115	Faint NLC discernible for short period low N on film from Edinburgh. Observation from Basel Observatory started 2030 GMT and reported a strip of light yellow colour.	56°N 47.5°N	03°W 07.5°E	0030 2030	10 5	360 315–360
6/7		0110	NLC bands visible at Leuchars between tropospheric cloud. Sky obscured at times of previous and later observations.	56.5°N	03°W	0110	–	–
7/8		2330–0200	NLC visible over the period on film from Edinburgh, and for one observation from Dyce at 0130.	57°N 56°N	02°W 03°W	0130 0130	– 10	– 360
8/9		2130–0200	In spite of sky brightness at 60°N Mr Parviainen, Turku, was able to photograph his first display of the season, which almost filled N sky with typical wave formations, drifting N–S, and additionally a curved band originating near sun's position below horizon curving to 50° elevation. Slightly south of his position at Jönköping and Visby, display recorded over 3 hours, with varying brightness. All forms of NLC noted. Curved bands recorded at Benbecula at later time, and at Tiree very bright billows seen against veil background.	60°N 58°N 57.5°N 57.5°N 56.5°N	22°E 14°E 18.5°E 07.5°W 07°W	2200 2210 2300 2130 2200 2230 2345 0015 2120 2220 2250 2345 0020 2355 0100 0200	60 90+ 90+ 30 30 20 20 20 45 30 20 20 15 20 – 40+	360 360 360 300–030 330–015 330–010 320–010 310–350 330–020 340–030 340–040 290–060 290–040 010–050 360–045 360
9/10		2145–2245 2400–0100 0145–0215	Faint display of NLC seen Turku forms mainly rising E and N, drifting NE–SW (photographs). From Tiree 2 faint bands seen against very faint veil. Photographs from Edinburgh showed bands against brighter veil, above low tropospheric clouds.	60°N 56.5°N 56°N 55°N	22°E 07°W 03°W 04.5°W	2145 2200 2245 2400 0100 0200 0040	20 10 40 15 10 10 90+ 10 10 30 7	090 360 090 360 045 090 225 360 360 360 320–040
11/12		2400	From Tiree NLC bands and 'patch' visible above tropospheric cloud [to 5°].	56.5°N	07°W	2400	20	330–350
12/13		2215–0200+	NLC visible over this period on film from Edinburgh, finely structured and herring-bone formation developing on earlier veil. In later stages only veil visible in breaks in tropospheric cloud. At Benbecula faint streak of NLC visible after clearance of tropospheric cloud.	57.5°N 56°N	07.5°W 03°W	0200 2400 0130	17 10 20	010 360 360
13/14		0130,0230 0205–0235	Bright and banded veil seen on Edinburgh film, and later at Leuchars after clearance of tropospheric cloud. Patch and billows seen W. London	56.5°N 56°N 51.5°N	03°W 03°W 0.5°W	0230 0130 0205	20 15 7	360–030 360 030
14/15		2150–2315 0100	Hazy, faint NLC first visible W and zenith at Turku, quickly filling N and W sky to 120° elevation. Further bands forming to W and E, fading S of zenith. Small patches of NLC visible Boulmer at later time.	60°N 55.5°N	22°E 01.5°W	2200 2230 2250 0100	120 50 90 15	180 270 90 040
16/17		2140–0130	Series of NLC bands rising NE and NW, varying brightness, seen Turku [photographs], drifting S and fading. Later bands irregular in shape, remaining bright until tropospheric cloud covered sky. From film at Edinburgh display seen to be extensive with bright herring-bone formation, but largerly obscured.	60°N 56°N	22°E 03°W	2200 2210 2220 2245	30 40 40 20 40 40 –	045 360 045 340 360 010 360
17/18		2150–0020	Bright banded veil visible Visby for some hours, becoming less bright later.	57.5°N	18.5°E	2150 2250 2350 0020	30 30 40 45	350–040 350–040 010–060 030–090
18/19		2145–2245	Medium-bright NLC visible Turku in breaks of tropospheric cloud [photographs].	60°N	22°E	2145 2245	40 15	360–045 360–045
23/24		2300	Possible sighting of NLC at Kinloss in tropospheric cloud breaks.	57.5°N	03.5°W	2300	–	360

Date — night of		Times UT	Notes	Station position*		Time UT	Max. elev.	Limiting azimuths *degrees*
24/25		2050–2120	Medium brightness NLC bands visible at Visby, fading within an hour. NLC also visible Lerwick and Dyce.	60°N	01°W	2300	–	340–045
		2300–0100				0100	–	340–045
				57.5°N	18.5°E	2050	30	010–040
						2120	30	010–040
				57°N	02°W	2300	–	045
26/27		0130	Faint showing of NLC on film from Edinburgh.	56°N	03°W	0130	–	360
29/30		2240–0030	Bright billow formation NLC visible at Sundsvall for 2 hours.	62.5°N	17.5°E	2240	30	340–020
		0200	NLC visible later on film from Edinburgh.			0030	30	340–020
				56°N	03°W	0200	15	045
30/31		2340–0050	Bright, becoming medium bright, veil and whirl formation visible	58°N	14°E	2340	20	320–340
		0325–0340	Jönköping around midnight. The possible sighting at the later time			0020	20	310–330
			from Kinloss was described as bright red lenticular cloud visible in			0050	30	310–360
			gaps in stratocumulus.	57.5°N	03.5°W	0330	8	044
1/2	Aug.	2130	Possible sighting of NLC from Newton Stewart.	55°N	04.5°W	2130	–	–
4/5		2100	NLC visible at high elevation at Fiane.	59°N	09°E	2100	90	–
6/7		0200	Multiple NLC bands visible Reykjavik NNE. 5/8 tropospheric cloud obscured earlier and later observations.	64°N	22°W	0200	–	020
9/10		2200,2300	Faintly visible patch of NLC visible Turku. At Benbecula NLC very	60°N	22°E	2200	35	045
			bright but seen between breaks in tropospheric cloud, fading later	57.5°N	07.5°W	2200	–	360
			to very faint veil.			2300	–	360
10/11		2340–2400	Bright bands of NLC visible Turku, N–S orientation, height increasing slightly during observation — N edge hidden by stratospheric cloud.	60°N	22°E	2340	8	360
11/12		2123	Report of possible NLC bands from RAF Mount Batten is thought to be	59°N	09°E	2123	–	–
		0120–0305	unlikely, as solar depression angle greater than usually acceptable.	50.5°N	04°W	0120	–	–
			Earlier report from Fiane of NLC veil to high elevation in westerly direction when SDA approx. 6°.					
14/15		2400	Bright bands of NLC visible Reykjavik.	64°N	22°W	2400	–	360–030
22/23		2100	Possible sighting of NLC bands from Wick [aurora visible later].	58.5°N	03°W	2100	–	340–020
10/11	Sept.	2045	NLC veil visible Fiane in breaks in tropospheric cloud.	59°N	09°E	2045	–	–

Photographs

6/7	June	2335–0115	D. Gavine, Edinburgh
		2315	Edinburgh Met. Dept
22/23		2250–2330	D.A.R. Simmons, Milngavie
		2330–0030	Edinburgh Met. Dept
26/27		2345–0100	Edinburgh Met. Dept
28/29		0001–0200	Edinburgh Met. Dept
1/2	July	2330–0100	Edinburgh Met. Dept
3/4		0030	Edinburgh Met. Dept
4/5		0001–0115	Edinburgh Met. Dept
7/8		2330–0200	Edinburgh Met. Dept
8/9		2150–2300	Mr Parviainen, Turku
9/10		2145–2245	Mr Parviainen, Turku
		0145–0215	Edinburgh Met. Dept
12/13		2215–0200	Edinburgh Met. Dept
13/14		0130	Edinburgh Met. Dept
16/17		2140–2240	Mr Parviainen, Turku
		2230–0130	Edinburgh Met. Dept
18/19		2145–2245	Mr Parviainen, Turku
26/27		0130	Edinburgh Met. Dept

Note

The corresponding survey for the 1982 NLC season will be the last to be made under current arrangements. The report for 1982, with a summary for the whole period of the survey (1964–82), will appear in an edition of *The Meteorological Magazine* in 1983.

The authors will be glad to receive suggestions as to how a survey, perhaps of a less detailed kind than previously, may be continued for the 1983 season and beyond.

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Meteorological satellites: a current survey

Prepared by the Satellite Meteorology Branch

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Summary

An account is given of all operational and research satellites, current and planned, that yield (or are intended to yield) data of meteorological interest. The type of data produced and their availability are described.

1. Introduction

The purpose of this paper is to provide a list of all satellites with a meteorological role, to indicate their purpose, and to discuss the availability of data. The list is presented in three sections: current operational meteorological satellites; current or recent research satellites; and future programs and satellites. More detailed information on the first two of these categories can be found in a World Meteorological Organization publication (WMO 1975). Satellites, such as LANDSAT, which are intended primarily to provide very high resolution pictures for study of the earth's surface have not been included, though their data can sometimes be useful in meteorological research. Satellites observing planets other than Earth have been excluded.

Meteorological satellites can be classified according to their orbit. Firstly those in low (about 1000 km) circular orbits inclined steeply to the earth's equatorial plane are known as polar-orbiting satellites. By suitable selection of height and inclination, the orbit plane can be arranged to precess about the earth's axis once per year so that the satellite always crosses the equator at the same local time. Such 'sun-synchronous' orbits can be used to provide global coverage of observations twice per day (once in daylight, once at night). To obtain more frequent observations at low- and mid-latitudes it is necessary to have more than one satellite. Secondly there are 'geo-synchronous' (often termed geostationary) satellites. These are in circular orbits at a height of about 36000 km over the equator and have an orbital period of 24 hours. Thus these satellites keep pace with the rotation of the earth. In this orbit a large part of the earth is continuously visible to the satellite and the frequency of images is limited only by the instrumentation (in most cases, a complete disc image is produced every 30 minutes). This frequency of images allows air motions to be deduced from the displacement of clouds and the diurnal cycles in cloud development to be studied. To achieve complete coverage up to mid-latitudes, five satellites are required spaced around the equator. Polar regions* cannot be seen from this orbit. Research satellites may be in different orbits, chosen to match the requirements of their experiments.

The satellites to be described in this paper are listed in Table I.

2. Current operational satellites

2.1 Polar-orbiting satellites

During the 1960's the USA launched 22 research or operational satellites into low earth orbit. Their second operational generation was known as ITOS and ran to six members. The last of these, called NOAA-5, was turned off in March 1979. A list of all these satellites can be found in *Satellite Activities of NOAA 1980*. (It is US practice to call the first satellite of a series by the name of the series. Subsequent

*beyond about latitude 70°

Table I. *Recent, current and proposed satellites and programs*

Current operational satellites:
Polar-orbiting satellites TIROS-N*† (NOAA), DMSP, Meteor-2
Geostationary satellites GOES†, Meteosat*†, GMS (HIMAWARI)

Current and recent research satellites:
NIMBUS*†, Meteor, HCMM (AEM-A), SEASAT†, GEOS-3, ATS, SAGE (AEM-B)†, SME, plus others

Future programs and satellites:
Polar-orbiting operational satellites TIROS-N*†, DMSP, Meteor-2
Geostationary operational satellites GOES†, Meteosat*†, GMS, INSAT, GOMS
Semi-operational satellites for oceanography and meteorology MOS, NOSS, ERS-1*†
Research satellites ERBS†, EXOS-C, UARS*†, Shuttle/Spacelab
Geostationary communications satellites with special relevance to meteorology SIRIO-2*†, INMARSAT*

*Denotes satellites to which the UK contributes (or is likely to contribute) directly in money or by providing instruments.
†Denotes satellites to whose data the Meteorological Office has direct or privileged access.

Notes.
Names (with alternative names in brackets) usually apply to several more or less identical satellites in a series, each with its own number.
INMARSAT is not strictly a satellite; see text.

spacecraft bear the name of the organisation e.g. NOAA (National Oceanic and Atmospheric Administration) — and a serial number, which carries over from one series to the next and is given only if the satellite comes into use. Before launch each follow-on satellite in a series is identified by a letter, which runs in sequence from A.)

The current series of US civil satellites is known as TIROS-N. There are two active satellites: NOAA-6 (launched June 1979) and NOAA-7 (June 1981). They are in sun-synchronous orbits, at heights of about 850 km, with northbound equator crossing times of 1930 and 1430 'apparent' solar time respectively. Their payloads provide visible and infra-red cloud pictures (in 4 spectral channels on NOAA-6 and 5 on NOAA-7), temperature and humidity sounding (by infra-red and microwave techniques) and a means of locating and receiving messages from meteorological sensors on sea, land or in the air. All data are broadcast in real time and some are tape recorded for processing in the USA. Routine NOAA products include atmospheric temperature profiles and sea surface temperatures. The Meteorological Office is providing one of the instruments (the Stratospheric Sounding Unit (SSU)) for these satellites.

The US Air Force operates DMSP (Defense Meteorological Satellite Program) satellites. They normally have two satellites operating in sun-synchronous orbits also at a height of about 850 km. The satellites provide visible and infra-red cloud pictures and incorporate a facility for night-time visible imagery by moonlight. Other sensors include an infra-red temperature sounder. Data transmissions from these satellites are in cipher.

The USSR also operates a series, known as Meteor-2. They provide visible and infra-red cloud pictures; low resolution versions are broadcast. Some members of the series carry a simple infra-red temperature sounder.

2.2 Geostationary satellites

The USA operates satellites producing visible and infra-red cloud pictures, which are disseminated (by the satellite after ground processing) in digital and analogue form, and providing a data collection service. Winds are derived from the motion of clouds seen in sequences of pictures taken at 30 min intervals. The pictures are produced by satellites located over the equator at about 75°W and 135°W. Spacecraft in these positions are often referred to as GOES-East (or GOES-E) and GOES-West, whilst a

third 'station' at about 107°W, used for some of the dissemination services, is called GOES-Central. GOES stands for Geostationary Operational Environmental Satellite. Each satellite is also given a serial number in accordance with the scheme mentioned in the previous section. The two latest, GOES-4 and GOES-5, carry an experimental high resolution temperature and humidity sounding facility (known as VAS) which also produces the operational imagery.

The European geostationary satellite Meteosat-2 was launched in June 1981 and is located over the Greenwich meridian. It provides similar imagery and dissemination services to GOES and in addition produces pictures showing the distribution of water vapour in the upper troposphere. It is essentially a replacement for Meteosat-1 (launched in November 1977) but since its on-board data collection and relay facility is faulty, Meteosat-1 (now at 10°E) is still being used for this service. Regular distribution of quantitative products such as winds, sea surface temperatures and cloud analyses has been delayed by installation of new computers at the ground processing centre, but it is expected to begin in the spring of 1982.

Japan is operating GMS-2 (Geostationary Meteorological Satellite, sometimes called HIMAWARI), again providing similar services to GOES. Products include nephanalyses, sea surface temperatures and cloud analyses as well as winds. GMS-2 at 140°E was launched in August 1981 as a replacement for GMS-1 (launched July 1977). GMS-1 remains available as a spare or back-up spacecraft.

International collaboration between operators, through meetings of the group for Co-ordination of Geostationary Meteorological Satellites (CGMS), has resulted in compatibility between data-collection systems and to a lesser extent in the dissemination services. However, there are significant differences in performance of the image systems: GOES provides the highest resolution (1 km) visible images, whilst Meteosat has the highest spatial resolution (4.5 km) in the infra-red and a third spectral channel.

3. Current and recent research satellites

NIMBUS. This has been the principal US NASA (National Aeronautics and Space Administration) series of polar-orbiting research satellites, extending from NIMBUS-1 (launched in 1964, the first earth-stabilized satellite and night-time cloud pictures) to NIMBUS-7 (October 1978) which concluded the series. These satellites are also referred to by corresponding letters (e.g. G for 7). Each satellite has carried a different and successively more complex payload. NIMBUS-7 carried eight instruments, for studying: sea surface roughness, precipitation, soil moisture, snow and ice cover; sea surface colour; clouds and surface temperature; radiation balance; ozone; stratospheric aerosol; temperature and minor constituents from 15 to 100 km. The Department of Atmospheric Physics, of Oxford University, provided a limb-sounding radiometer for minor constituents and has flown extremely successful temperature sounding radiometers on earlier NIMBUS spacecraft. WMO Publication No. 411 (WMO 1975) lists the last three payloads and indicates which instruments are still working. Data recovery is now very limited from NIMBUS-6.

METEOR. Several USSR Meteor satellites (e.g. -25, -28, -29, -30) have been devoted to research, carrying various infra-red and microwave radiometers for studies of clouds and the earth's surface.

HCMM. (Heat Capacity Mapping Mission). This NASA satellite, launched into sun-synchronous orbit in 1978, was the first Applications Explorer Mission and so was sometimes called AEM-A. It provided visible and infra-red images, with 0.5 km resolution, at times when surface temperature was near its maximum and minimum. These are being used to test methods for deducing soil moisture data and for snow mapping. Operations terminated at the end of September 1980.

SEASAT. A NASA satellite, launched June 1978, which operated for only 3 months (also referred to as SEASAT-A and as Ocean Dynamics Satellite). It carried microwave sensors (altimeter, scatterometer, synthetic aperture radar, passive radiometer) to provide information on surface winds,

wave heights, wave spectra, sea surface topography (currents have been located) and ice. A simple radiometer provided cloud pictures. All data were transmitted in real time. The low-power and data-rate sensors were used continuously and their data are being processed in the USA. The life of SEASAT overlapped the JASIN (Joint Air-Sea Interaction) experiment and the RAE Oakhanger facilities were used to receive the relevant data.

GEOS-3. (Geodynamics Experimental Ocean Satellite). This NASA satellite carried an earlier version of the SEASAT altimeter and demonstrated the feasibility of deriving significant wave heights.

ATS. (Applications Technology Satellite). Three satellites in this US NASA series have carried meteorological sensors. ATS-1 and ATS-3 were the first geostationary satellites to carry cloud cameras. They were launched in 1966 and 1967 respectively. From 1969 their visible pictures and telecommunications relay facilities were used in a semi-operational role and winds were derived (from cloud motions). Their cameras were used for six and eight years respectively. ATS-6, launched in 1974, was a 3-axis stabilised geostationary spacecraft primarily for telecommunications research. It also carried an infra-red and visible-imaging radiometer.

SAGE. (Stratospheric Aerosol and Gas Experiment). This is a NASA satellite, also known as AEM-B, launched in February 1979 to measure profiles of aerosol attenuation, ozone and nitrogen-dioxide in the stratosphere.

SME. (Solar Mesosphere Explorer). This is another NASA satellite. It was launched into sun-synchronous orbit in October 1981 to measure minor constituents (e.g. ozone, nitrogen dioxide, water-vapour) and temperature in the upper-stratosphere and mesosphere. The experiments are all from within the USA and principally from the University of Colorado.

Other experimental satellites and manned spacecraft (e.g. Skylab) have been used to provide observations relevant to meteorology. Two of special interest were the joint US/UK Ariel-2 satellite, which in 1964 carried Office experiments to study ozone and dust, and the French EOLE, which, with its fleet of super-pressure balloons, provided important information on winds in the lower stratosphere.

4. Future programs and satellites

4.1 Polar-orbiting operational satellites

TIROS-N. There are firm plans to carry the TIROS-N program into the 1990s. Starting with NOAA-8, a somewhat larger spacecraft, ATN (Advanced TIROS-N), will be used that can carry additional payload and provide more power. Instruments to measure radiation fluxes (see ERBS below) and ozone will be included from about 1984, and an improved microwave sounding instrument may be flown around 1990. The latter would provide better height and spatial resolution for temperature and humidity sounding under cloudy conditions. It would also make temperature measurements up to 50 km, taking over the role of measuring temperatures in the upper part of this height range from the Meteorological Office's Stratospheric Sounding Unit.

DMSP. No information is available but it is believed that this US Air Force series will also continue through the 1980's.

METEOR-2. No information is available on long-term plans but new satellites are being launched periodically to maintain the service.

4.2 Geostationary operational satellites

GOES. The US geostationary system with satellites at 75° W and 135° W is expected to continue for a long time to come — certainly well into the 1990's. A third satellite will probably be operated near 100° W for much of the time, to provide image dissemination services. Construction or procurement of a further four spacecraft for the program is already in hand.

METEOSAT. There is at present no guarantee of any successor to Meteosat-2 which it is hoped will operate to around 1984. Over the past year or two there have been discussions of ESA (European Space Agency) proposals for an operational program, EUMETSAT, which (if adopted in full) would provide observations at 0°W for a 10-year period using five satellites. Although many European nations have indicated their interest in such a program, no firm commitments have yet been made.

GMS. It is understood that a third spacecraft in the series is being, or has been, built and may be launched as GMS-3 in 1984.

INSAT-1. This Indian satellite system will provide telecommunications and broadcast television services as well as carrying a visible and infra-red radiometer for imagery. The satellites are being made by a US company and are 3-axis stabilised. A meteorological data processing centre is being established in New Delhi. Image dissemination and data collection services will be provided as part of the telecommunications service. INSAT-IA is expected to be launched in 1982 and will be positioned at 74°E. INSAT-IB will probably be launched quite soon afterwards, as an in-orbit spare.

GOMS. (Geostationary Operational Meteorological Satellite). This satellite, originally promised by the USSR for FGGE (First GARP Global Experiment), has not yet been launched. It is understood, however, that the USSR plans to launch two or three geostationary meteorological satellites over the next few years.

4.3 Semi-operational satellites for oceanography and meteorology

MOS. (Marine Observation Satellite). This is a Japanese semi-operational satellite to monitor atmospheric water content, sea surface temperature and colour, and sea-ice, using microwave radiometers and infra-red and visible imagery at medium and high spatial resolution. MOS-1 should be launched into sun-synchronous polar orbit in early 1985, with MOS-2 in 1986.

NOSS. (National Oceanic Satellite System). Work on this program, which was being jointly funded in the USA by NASA, NOAA and the Department of Defense, has now been stopped. Launch had been provisionally set for 1985.

ERS-1. (Earth Remote Sensing). The Members of ESA are expected to agree early in 1982 to the Definition Phase of this ocean monitoring satellite to be launched about 1987. The instrument payload will include a combined wind/wave scatterometer and synthetic aperture radar, and a radar altimeter. A final decision on development of the satellite will be taken in mid-1983.

4.4 Research satellites

ERBS. (Earth Radiation Budget Satellite). This is a US NASA experimental satellite primarily for the measurement of incoming and outgoing short- and long-wave radiation. The orbit plane will precess, providing observations at differing solar times which will complement those from similar sensors on TIROS-N series spacecraft (at fixed solar time). University College London (UCL) will be participating in data analysis and interpretation. ERBS will also carry SAGE-II, a NASA experiment for measuring vertical profiles of aerosol and ozone in the stratosphere by occultation techniques. It is planned to launch ERBS in May 1984.

EXOS-C. An experimental Japanese mission to study minor constituents in the stratosphere, mesosphere and lower thermosphere. Payload is expected to include airglow, ultra-violet back-scatter, solar occultation, and infra-red limb-sounding sensors. It is proposed to be launched around 1984 into an elliptical 65° orbit.

UARS. (Upper Atmosphere Research Satellite). Comprehensive investigation of composition, dynamics and energetics of stratosphere, mesosphere and lower thermosphere. NASA experimental spacecraft in polar-orbit. Payload not yet decided but is likely to include from Oxford an advanced infra-red limb-sounder for minor constituents and an interferometric limb scanner for winds, in which UCL are involved. The Office is participating in the planning and expects to be involved through

analysis of the various observations and by modelling. This satellite is expected to be launched around 1988. The NASA HALOE (Halogen Occultation Experiment) experiment for measuring vertical profiles of minor constituents (e.g. HCl, CF_2Cl_2) in the stratosphere, previously included in the ERBS payload, is now likely to be flown on UARS instead. The Meteorological Office is represented on the science team of HALOE.

Shuttle/Spacelab. This facility will be used to fly a number of short period experiments of meteorological interest. Experiments already proposed include: microwave and cooled infra-red limb-sounding radiometers to measure profiles of minor constituents (e.g. freons) in the upper atmosphere; interferometers for measuring winds; lidar systems for measuring aerosols, and cloud-top height, winds and surface pressure; and instruments to monitor in-coming solar radiation. Unfortunately, after the First Spacelab Payload (FSLP), there is no definite provision for European experimenters. The share of flight costs on subsequent missions will be a major constraint.

4.5 Geostationary communications satellites with special relevance to meteorology

SIRIO-2. This experimental ESA satellite will carry a system known as MDD (Meteorological Data Dissemination) to demonstrate the use of telecommunications via a geostationary satellite for collecting and distributing meteorological messages between national and regional centres. Launch is planned for Spring 1982 with a 2-year operating life. The experiments will mainly involve centres in Africa.

INMARSAT. This is actually not a satellite but an international organisation concerned with the exploitation of communication satellites to increase the efficiency of maritime communications. Initially, INMARSAT is using satellites operating in the experimental MARISAT scheme but they will be superseded in 1982 by purpose-built systems carried on the INTELSAT V satellites together with the MARECS-A and MARECS-B communication satellites. In meteorology the system is likely to be used extensively for 2-way transmission of data between ships (including platforms and rigs) and shore stations, i.e. for sending observations to collecting centres for insertion on the GTS (Global Telecommunication System), and for transmitting forecasts, warnings, routeing advice, etc. to vessels at sea.

5. Availability of data

For instruments which produce only modest amounts of data it is usual for the data to be recorded on the spacecraft and replayed to a central ground station provided by the spacecraft operator. In these cases the operator acquires all the data and may use them and archive them, either in raw or condensed form. Image data may be stored only as photographs. For polar-orbiting satellites data from several successive orbits may be merged and presented, for instance, in a polar stereographic projection.

Image data from geostationary spacecraft are voluminous. Each Meteosat image comprises 30 million 8-bit numbers providing a potential of 1.5×10^9 numbers per day. This is one reason why products, such as winds, are produced centrally for distribution by normal channels. Archives of these data by the operator are generally selective (e.g. 8 images/day), particularly in digital form. Retention may not be permanent. Proposals have been made for a condensed format, suitable for climate and radiation studies, which could be generated from the images and held permanently. Users may also create their own specialized partial archive based on disseminated data.

Most high spatial resolution sensors on polar-orbiting satellites transmit their data immediately. Data are recovered only for those areas which are within range of a suitable reception facility. (However, up to 10 minutes of high resolution image data can be recorded during each orbit for the TIROS-N series.) Data of this type are not generally held by the satellite operator and archive policy depends on the local reception station. An example of this in the UK is the Dundee University service for the 1 km visible and infra-red pictures produced by the current TIROS-N series spacecraft financed by NERC (Natural

Environment Research Council). It is often necessary to refer back to the satellite operator (or experimenter) for supplementary information.

The Meteorological Office has facilities for direct reception (through the RAE Lasham station) and immediate distribution (by landline) of satellite pictures. All the 4 km resolution pictures from the current spacecraft of the TIROS-N series (covering most of the North Atlantic and Europe from North Africa to the Arctic) are received four times each day. Limited areas (UK and North Sea) taken from the high resolution 1 km imagery are also distributed.

The facilities can also handle selected Meteosat data and image data for North America and the Pacific relayed via GOES-East. The Meteorological Office receives, within a few hours, via its normal telecommunications channels, temperature profiles for the northern hemisphere extracted by NOAA from sounding instruments on the TIROS-N spacecraft and winds for the belt 50°N to 50°S derived from the images of various geostationary spacecraft by the appropriate operators. Meteorological messages obtained through the various satellite data collection systems are received in the same manner.

Archived data from current and many past US operational satellites (including DMSP) can be obtained from NOAA's Environmental Data and Information Service (EDIS). They issue Satellite Data User Bulletins, which describe their stocks. Data from the Meteorological Office's SSU are also archived at Bracknell and are available to external users in various forms (see Pick and Brownscombe 1981). Meteosat data and products can be obtained from ESA at Darmstadt; GMS data and products from the Meteorological Satellite Centre in Japan.

Archived data from these satellites are available without restriction, usually at the marginal cost of reproduction. Charges may be higher for commercial and foreign users. Products (winds, temperatures) are generally archived by Meteorological Services alongside the other global meteorological observations which they receive.

Data from research satellites conventionally belong to the experimenter, who has a responsibility to publish his results. In recent years there has been increased emphasis on the formation of Experiment Teams, to include those who want to use the data as well as those providing the instruments. Privileged access to data is given to members of such Teams and special arrangements are made for exchange of data between Teams. Data are subsequently released to other workers, either informally through the principal scientist or formally by announcements of opportunity for data use. These arrangements have generally improved the accessibility of data from research satellites.

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100 years ago*

DAILY ATLANTIC WEATHER MAPS.

Almost, if not quite, all our readers must be aware how long and earnestly we have pleaded for the preparation and publication of Daily Maps of Atlantic Weather.

There are, however, two statements respecting the subject, the reproduction of which is needed to complete the narrative. Both are by Mr. Symons, one, the concluding paragraph of a letter published in *The Times* of Oct. 28th, 1881, is as follows:-

As regards the study of Atlantic weather, no one desires its development more than I do. For years I have urged that we ought to have daily weather charts for the Atlantic, and the only reason that we have them not is that they would cost a few thousands per annum. This is, of course, work which lies wholly within the domain of the Government establishment, the Meteorological Office, and their accounts show that they could only establish such a system either at the cost of suppressing some of their existing observatories, or on receiving an increased vote. I think personally that Parliament could do few wiser things than to appropriate, say for five years, £4,000 per annum for that purpose. Being entirely unconnected with the Meteorological Office, and not a member of its council, this proposal may perhaps be appropriately made by

Your obedient servant,

October 27th, 1881. G.J. SYMONS, F.R.S.

Symons's Monthly Meteorological Magazine*, **17, 1882

The other reference is a portion of the Presidential Address to the Meteorological Society:-

I must, however, pass to a different class of subject, that of deductions as distinguished from that of instruments. First in that list I place Daily Maps of Atlantic Weather on a scale of not less than 1 inch to 300 miles. The compilation of such charts is essentially national or international work, and falls wholly within the domain of the Government office. Years ago Captain Toynbee showed us what could be done. I have long pleaded for their regular issue, and shall continue to do so, because, irrespective of their utility as contributions to Physical Geography and to Navigation, they are, I believe, the best helps towards increased accuracy in weather forecasting. I am glad to plead this cause in the very words of the Meteorological Council, for when they published Captain Toynbee's charts they said –

"The Meteorological Council have authorised the present publication as a remainder of the work of their predecessors. It cannot be doubted that more work of the same nature as that here submitted would throw light on the atmospherical conditions which influence and determine the weather in the West of Europe."

Moreover, in thus writing, the Meteorological Council only repeated what Le Verrier had urged a dozen years previously, viz., on January 29th 1864, when, speaking of the charts in the *Bulletin International*, and pleading for Meteorological Records from the Atlantic, he said –

"Unfortunately our charts embrace only Europe, which is not sufficient. They contain nothing of what is occurring on the surface of the ocean, and this is the more to be regretted since most of the storms which attack us seem to take their rise in those parts."

These being our views, it will readily be understood that it was with extreme pleasure that we saw in *The Times* the memorandum which we reprint verbatim at the end of this note.

We have, however to call attention to one decision of the Office, for which no reason is given, and which, at present, appears to us a mistake. Our readers are aware of the system of eight-hourly synchronous observations introduced by the Signal Office of the United States. By this system observations are made at hundreds of stations all over the globe at the same instant of absolute time, viz., at 7 a.m., 3 p.m., and 11 p.m., Washington mean time, which is approximately synchronous with noon, 8 p.m., and 3 a.m. (of the following day) Greenwich mean time.

This system was expressly designed to facilitate and perfect the class of investigation which the Meteorological Office is now going to push forward.

On the other hand the log-books issued by the office are arranged for observations *not* synchronous, but made at fixed hours of local time, so that the observation to be made for log-book purposes at 8 a.m., local time would, off the West of Ireland, be made at 9 a.m. Greenwich time; and the corresponding 8 a.m. entry at Bermuda would be made at about 5 a.m. Greenwich time.

The memorandum asks for observations at 8 a.m., and at noon, local time; the first of these will range between 3 and 8 a.m., Washington time, and the second between 7 a.m. and noon, Washington time. The first may therefore be anything between four hours before, and one hour after the 7 a.m. Washington synchronous observations; and the second may be anything between identical with the 7 a.m. Washington Synchronous observations, and five hours after them.

Although it is possible that the total number of observations collected may be greater by adopting the system selected by the Meteorological Office, we think that the advantage so gained will be far outweighed by the difficulties introduced by the abandonment of the synchronous principle.

We presume that it is intended that the charts shall represent the weather at noon Greenwich time, which, as we have said, may be taken as the equivalent of the 7 a.m. Washington synchronous observation, but curiously enough the memorandum ignores the synchronous observations, and does not say for what hour the charts are to be constructed.

We, however, believe the above surmise to be correct, and that the intention is to correct the 8 a.m. and noon (local time) readings to what it is believed they would have been at the hour adopted for the charts. Although we have implicit faith in the care with which this will be done under Captain Toynbee's supervision, we adhere to the opinion previously expressed, that the ignoring of the synchronous system is a mistake. Of course it will be urged that an observation to be made daily at a different time (because of

the change of the ship's position), would be less easily obtained that two at fixed hours. But it would be very easy to prepare a printed table showing the time for each degree of longitude, and the fewer the corrections applied to observations the better.

DAILY WEATHER CHARTS FOR THE NORTH ATLANTIC OCEAN.

The Following statement has been issued by the Meteorological Office:-

"The Meteorological Council propose to undertake the preparation of daily weather charts of the North Atlantic Ocean for the 13 months beginning on August 1 in the present year, and ending on August 31, 1883.

"It is well known that the changes of weather which we experience are in general caused by atmospheric disturbances which travel more or less rapidly, and undergo more or less modification during their progress. By far the larger number of the disturbances which visit the British Islands arrive on our shores from the Atlantic Ocean, and our earliest information as to any impending change is consequently derived from telegraphic reports from the Atlantic coasts, especially from the British stations at Stornoway, Mullaghmore, and Valentia, and occasionally from the continental observatories at Rochfort and Corunna. But of the origin and previous history of these systems we have no sufficient knowledge, except in a few isolated cases.

"The Meteorological Council believe that any systematic information which can be obtained as to the origin, development, and laws of motion of the atmospheric disturbances which occur over the Atlantic Ocean would promote the science of meteorology, and be of immediate practical utility. Such information could not fail to be a benefit to seamen traversing the Atlantic Ocean, and would tend directly to the improvement of the forecasts and storm warnings issued to the British coasts, by rendering the interpretation of the first indications of approaching changes observed at the western meteorological stations more easy and certain.

"The importance of a systematic study of the weather of the North Atlantic Ocean has long been recognized, and series of daily synoptic charts, more or less resembling those now in contemplation, have been prepared at various times, not only by the Meteorological Office, but also by the Association Scientifique de France under the guidance of Le Verrier; by Captain Hoffmeyer, of the Danish Meteorological Institute; by the Deutsche Seewarte, at Hamburg; and (as a part of a wider plan) by the Chief Signal Officer of the United States. But none of these charts, however valuable in other respects, supply adequate materials for a satisfactory discussion of Atlantic weather, chiefly on account of the small number of the observations upon which they are founded as compared with the magnitude of the area over which they are spread.

"Evidence of the interest attaching to the connection between English and Atlantic weather is afforded by the efforts which have been made during the last few years by the proprietors of the *New York Herald* to transmit to England from America telegraphic predictions of approaching disturbances which (it is presumed) are founded on the reports of vessels arriving in America from the Atlantic Ocean. Reports such as these from a large number of vessels would be of great value; but the predictions taken by themselves cannot be utilised in a scientific investigation of weather.

"The Meteorological Council gratefully acknowledge the large measure of invaluable help which they have hitherto received from seamen and the shipping interest generally. But as the object now proposed can only be achieved by the voluntary co-operation of an increased number of observers, they feel justified in making a special appeal for assistance to the owners, captains, and officers of ships, and especially to the great companies whose steamers ply between this country and America. In a science which, like meteorology, is still in its infancy, every advance is attended with great difficulties, and the Council are well aware that it would be easy to be too sanguine as to the importance of the results to be obtained by the inquiry which they are about to undertake. But having regard to the loss of life and property occasioned by storms on our coasts, they feel confident that their proposal will commend itself to the public generally, and will insure the active co-operation of those classes of the community for whose benefit it is primarily intended.

"It is proposed to ask for observations of the barometer, of open air and sea surface temperatures, wind (direction and force) and weather at 8 a.m. and noon each day, with the position of the ship at noon.

"Forms for recording the observations will be supplied by the Meteorological Office, 116, Victoria Street, London, S.W., on application to the Marine Superintendent."

Award

Dr R. Hide, F.R.S., Head of the Geophysical Fluid Dynamics Laboratory, has been awarded the Holweck Medal and Prize of the French and British Physical Societies. The Medal and Prize are awarded in odd-dated years to a French physicist and in even-dated years to a British physicist. The award was instituted in 1945 as a memorial to Fernand Holweck, Director of the Curie Laboratory of the Radium Institute in Paris, who was tortured and killed by the Gestapo during the last war. It is given for distinguished work in experimental physics, or in theoretical physics if closely related to experimental work. Dr Hide is the first scientist to receive the award for work in geophysics.

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NOTICES

It is requested that all books for review and communications for the Editor be addressed to the Director-General, Meteorological Office, London Road, Bracknell, Berkshire RG12 2SZ and marked 'For Meteorological Magazine'.

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